Review article
UDC 656.2
doi: 10.46684/2025.3.01
EDN NSOROR

From the first public railway to high-speed rail transport. The 200th anniversary of the Stockton and Darlington Railway, England, and the 12th World Congress on High-Speed Rail 2025 in Beijing

Igor P. Kiselev
Emperor Alexander I St. Petersburg State Transport University (PGUPS); Saint Petersburg, Russian Federation; kiselev@pgups.ru

ABSTRACT On September 27, 1825, the world's first public railway, Stockton and Darlington, was opened in England, marking the beginning of railway transport, the current technical and technological achievements of which are largely embodied by high-speed railways. In July 2025, the 12th World Congress on High-Speed Rail in Beijing noted the continuity of the history of railway transport, from the first railways to high-speed railway lines, and discussed the prospects for their development. The first congress on high-speed rail was held in Brussels in 1992. Since then, the congresses, which are held by the International Union of Railways (UIC) every 2–3 years, have become a traditional forum for representatives of government and public organizations from different countries, railway companies, scientific and design institutes, manufacturers of rolling stock and other railway equipment, as well as universities engaged in the training of professionals for the transport industry. The purpose of the meetings is to review the implemented projects and make proposals for the development of high–speed services — a particularly important segment of railway transport. Igor Kiselev, a railway engineer, Doctor of Historical Sciences, Professor Emeritus of Emperor Alexander I St. Petersburg State Transport University (PGUPS), and Chief Scientific Editor of the BRICS Transport Journal, talks about the history of railways and the congress held in Beijing. In the light of the implementation of the first St. Petersburg–Moscow high-speed railway project in Russia, the results of the congress are of great interest to those engaged in railway transport, as well as employees of research organizations and specialized higher educational institutions.

KEYWORDS: first public railway; Stockton; Darlington; England; Beijing; China; Congress on High-Speed Rail; HSR; International Union of Railways

For citation: Kiselev I.P. From the first public railway to high-speed rail transport. The 200th anniversary of the Stockton and Darlington Railway, England, and the 12th World Congress on High-Speed Rail 2025 in Beijing. *BRICS Transport*. 2025;4(3):01. https://doi.org/10.46684/2025.3.01. EDN NSOROR.

Обзорная статья

От первой железной дороги общего пользования к высокоскоростному железнодорожному транспорту. 200 лет железной дороги «Стоктон и Дарлингтон», Англия и 12-й Всемирный конгресс по высокоскоростным железным дорогам 2025 г. в Пекине

И.П. Киселев
Петербургский государственный университет путей сообщения Императора Александра I (ПГУПС); г. Санкт-Петербург, Российская Федерация; kiselev@pgups.ru

АННОТАЦИЯ 27 сентября 1825 г. в Англии была открыта первая в мире железная дорога общего пользования «Стоктон и Дарлингтон», положившая начало железнодорожному транспорту, технические и технологические достижения которого сегодня во многом олицетворяют высокоскоростные железнодорожные магистрали. В июле 2025 г. на состоявшемся в Пекине XII Всемирном конгрессе по высокоскоростным железным дорогам в выступлениях участников отмечалась преемственность истории железнодорожного транспорта от первых железных дорог до высокоскоростных, обсуждались перспективы их развития. Первый конгресс по высокоскоростному железнодорожному транспорту прошел в Брюсселе в 1992 г. Подобные конгрессы собираются раз в 2–3 года Международным союзом железных дорог. Они стали традиционным форумом представителей государственных и общественных организаций разных стран, железнодорожных компаний, научных и проектных институтов, предприятий выпускающих подвижной состав и другую железнодорожную технику, а также университетов, занятых подготовкой специалистов транспортной отрасли. Цель встреч — анализ осуществленных проектов и выработка предложений по развитию столь важного сегмента железнодорожного транспорта, как высокоскоростные сообщения. Об истории железных дорог, о состоявшемся в Пекине конгрессе рассказывает его участник, а также участник десяти предыдущих конгрессов инженер путей сообщения, доктор исторических наук, почетный профессор Петербургского государственного университета путей сообщения Императора Александра I, главный научный редактор журнала «Транспорт БРИКС» Игорь Киселев. В свете реализации в России проекта первой высокоскоростной магистрали Санкт-Петербург – Москва итоги конгресса представляет большой интерес для работников железнодорожного транспорта, научных и профильных высших учебных заведений.

КЛЮЧЕВЫЕ СЛОВА: железная дорога общего пользования; Стоктон; Дарлингтон; Англия; Пекин; КНР; конгресс по высокоскоростным железным дорогам; ВСМ; Международный союз железных дорог

Для цитирования: *Киселёв И.П.* От первой железной дороги общего пользования к высокоскоростному железнодорожному транспорту. 200 лет железной дороги «Стоктон и Дарлингтон», Англия и 12-й Всемирный конгресс по высокоскоростным железным дорогам 2025 г. в Пекине // Транспорт БРИКС. 2025. Т. 4. Вып. 3. Ст. 1. https://doi.org/10.46684/2025.3.1. EDN NSOROR.

FROM FIRST STEAM LOCOMOTIVES TO HIGH-SPEED TRAINS. MILESTONES OF INCREASING RAIL TRAVEL SPEEDS

On September 27, 1825, the world's first public railway, Stockton and Darlington, was opened in England, marking the beginning of railway transport. From the 16th century, trackways were in use in some European countries solely as industrial transport for transporting goods for small distances at mines, quarries, and factories (*Fig. 1*).

In Russia, the first trackway with cast-iron L-shaped angle rails ("wheel tracks") domestically made was built at the Aleksandrovsky Factory in Petrozavodsk in 1788. Elements of this line's rail track have survived to this date (*Fig. 2*).

The construction of the first 40-km long intercity public railway, the Stockton & Darlington Railway, was organized by outstanding engineer George Stephenson (1781–1848) and businessman, promoter, and head of the construction Edward Pease (1767–1858). They overcame incredible organizational difficulties, built up public opinion in favour of building railways, brought together influential politicians and businessmen, raised funds, and successfully implemented the railway project using the state-of-the-art engineering and technological solutions. The best track of the time made of cast-iron and iron rails was laid and steam engines — the engineering marvel of the 19th century — began to be regularly used for the first time to haul trains. The Stockton & Darlington Railway was the world's first public commercial railway company that offered cargo and passenger transportation services for a predetermined fee to everyone (*Fig. 3*).

Fig. 1. Drawing of a mine road with a trolley, considered to be the first published drawing. 16th century. Fragment of an engraving. Universal Cosmography (Latin: Cosmographia universalis, 1544), a book by Sebastian Münster (1488–1552) [1]

Fig. 2. Surviving iron-cast wheel tracks of the trackway at the Aleksandrovsky Factory in Petrozavodsk. Permanent exhibition of the National Museum of the Republic of Karelia. 2017. Photo by Mikhail Semenov[1]

Fig. 3. John Dobbin (1815–1888). The opening of the first public railway Stockton & Darlington on September 27, 1825. Wash drawing, from a sketch by John Dobbin made at the age of 10 after attending the opening event. 78 × 133 cm, 1871. Science Museum. London[2].
The picture shows the first train hauled by locomotive *Active* (later renamed *Locomotion No. 1*). The train consisted of *Locomotion* (a locomotive with a tender), eleven wagons of coal, the carriage "Experiment" (it can be clearly seen in the picture: the eighth wagon, including the tender, from the locomotive), and further 20 wagons of passengers: special guests, and construction workmen

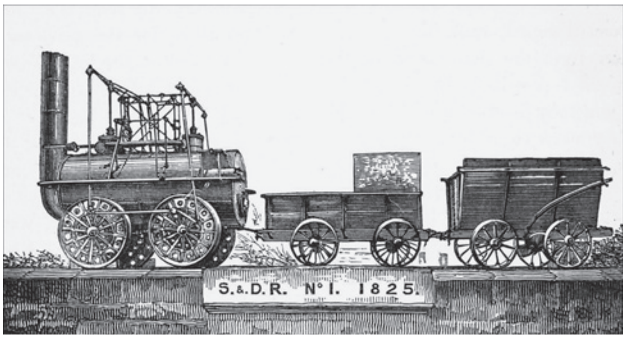


Fig. 4. *Locomotion No. 1*[3], the first steam locomotive of the Stockton and Darlington Railway, with a tender and one coal wagon kept as a monument[4]

The creation of the Stockton and Darlington Railway changed the paradigm of railways. From a *special-purpose* industrial transport suitable for carrying goods over short distances they turned into *all-purpose* intercity — and later international — railway transport for a wide range of customers: passengers, freight carriers, and consignors. The Stockton and Darlington Railway set a model of success both in terms of transport and commerce: *until 1860, the company was the most profitable railway in Great Britain with the average annual profit margin of 9.5%* [2].

Chief engineer George Stephenson built two important railways: the Stockton and Darlington Railway in 1825 and the Liverpool and Manchester Railway in 1830. Many historians consider the two to be one large project. Thanks to these railways, railway transport began to develop throughout the world.

The first steam locomotives travelled at a walking speed of about five km/h, but even so, they aroused fear in common people. It is notable that a horseman with a red flag was to ride in front of the train hauled by a locomotive to warn of danger on the Stockton and Darlington Railway. However, on the very first day of the railway opening, September 27, 1825, the train with *Locomotion No. 1* (*Fig. 4*) several times already reached a speed of about 15 km/h, forcing the riding "signalman" to give way, so that he later had a hard time catching up with the locomotive...

In 1829, the owners of the intercity railway Liverpool & Manchester, which was then under construction, tested locomotives for speed in order to find the

[1] https://commons.wikimedia.org/wiki/File:National_museum_of_Karelia_(1).jpg
[2] https://collection.sciencemuseumgroup.org.uk/objects/co227670/opening-of-the-stockton-darlington-railway-ad-1825-from-a-sketch-by-the-artist-at-the-time
[3] The locomotive was purchased, repaired (restored) and preserved by descendants of Edward Pease 50 years after the railway was built. Nowadays, the locomotive is exhibited at various exhibitions and in museums according to special regulations.
[4] Commemorating the past, shaping the future: the jubilee and centenary celebrations of the Stockton and Darlington Railway. URL: https://journal.sciencemuseum.ac.uk/article/commemorating-the-past-shaping-the-future-the-jubilee-and-centenary-celebrations-of-the-stockton-and-darlington-railway/

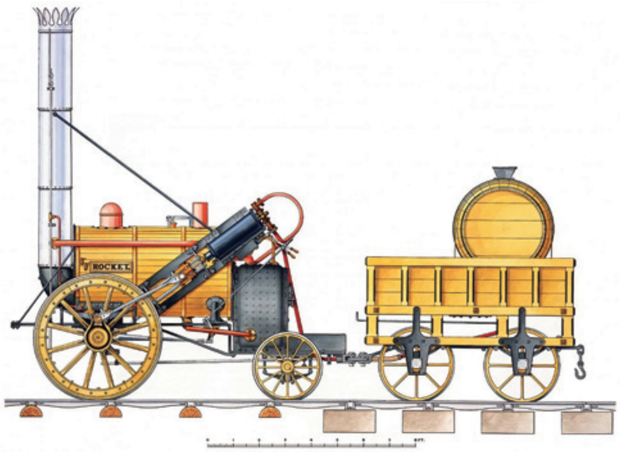


Fig. 5. Stephenson's Rocket – a steam locomotive with a tender as it was presented for a competition in 1829. National Railway Museum, UK / CCA 4.0[5]

best traction system. The famous competition (races) of steam locomotives was held in the area of Rainhill Station. The Rocket steam locomotive (*Fig. 5*) built by George Stephensen and his son Robert showed the average travel speed of 12 km/h during tests and achieved a maximum speed of 30 km/h. The creators were declared the winners [3].

This event — the world's first high-speed tests of steam engines — is the benchmark for the milestones of speed records in rail transport. For a long time, many historians believed the "round" number of 100 mph (160.9 km/h) to be a kind of boundary between normal traffic and high-speed traffic[6]. This speed limit was broken by *Hurricane*, a single speed steam locomotive, in a test (record-breaking) run on the Great Western Railway in the United Kingdom in September 1839 [4] (*Fig. 6*).

By the end of the 19th century, the best regular passenger trains in technically developed countries reached speeds of 80–90 km/h.

Started by the legendary *Rocket*, the steam traction era continued into the mid-20th century. In the first decades of the 20th century, remaining unchallenged on railways, steam locomotives enabled the best express trains in commercial service to reach speeds of about 110–120 km/h.

The speed record of 126 mph (203 km/h) for steam traction that has not been broken to this day was set in 1938[7]. On July 3, 1938, **LNER Class A4 4468** *Mallard* steam locomotive of the London and North Eastern Railway hauling a train of seven four-axle Pullman coaches (including a dynamometric carriage) reached a speed of 126 mph (203 km/h) (*Fig. 7*).

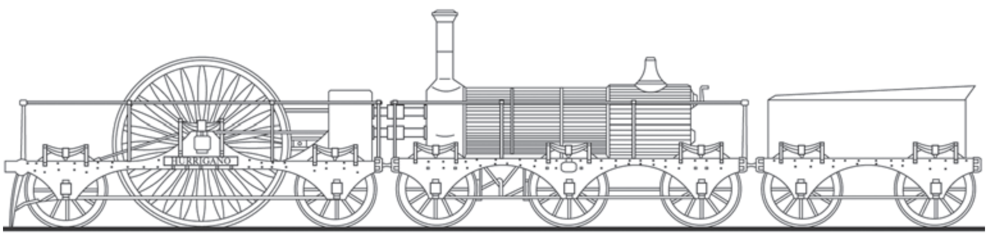


Fig. 6. Hurricane speed steam locomotive. Great Britain. 1839

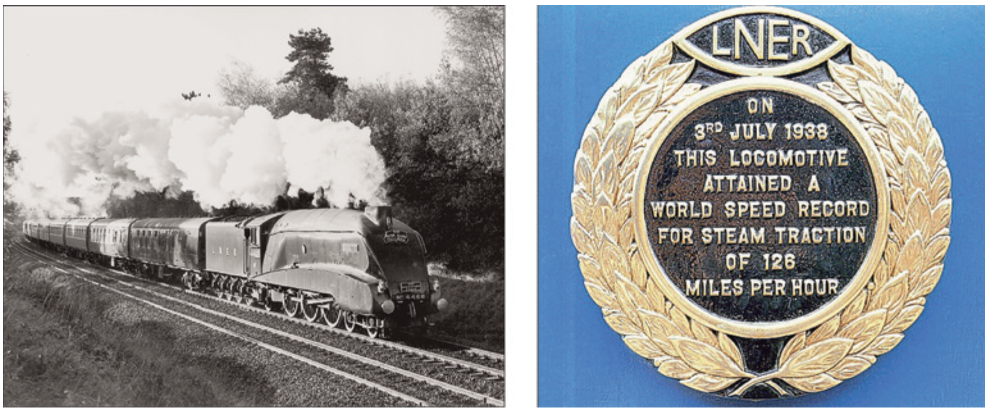


Fig. 7. Left: The fastest steam train in the world. Class A4 4468 Mallard steam locomotive, Great Britain. Photo taken in 1986. Right: Speed record commemorative plaque on the said locomotive. "LNER" at the top stands for the London and North Eastern Railway (the name of the railway) [5]

[5] The Rail Revolution. 2023. URL: https://technicshistory.com/2022/11/28/the-rail-revolution/
[6] Let us note that 160 km/h is still considered the boundary between "ordinary" and "high-speed" traffic.
[7] This broke the speed record of 124.5 mph (200.4 km/h) set by the DRG Class 05 No. 002 steam engine in Germany in 1936.

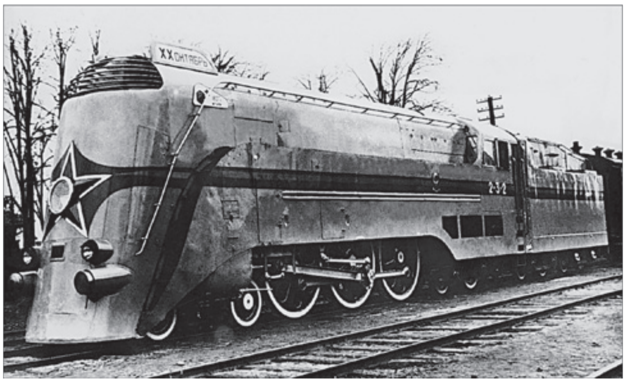


Fig. 8. The first of the two fast 2-3-2-type steam locomotives built by the Kolomna Plant. USSR. 1937 [5]

In the 1930s, the USSR also created several fast steam locomotives with aerodynamic fairings. In 1937, a high-speed 2-3-2-type locomotive (*Fig. 8*) was built under the guidance of engineers Lev Lebedyansky and Mikhail Shchukin at the Kolomna Machine-Building Plant. On June 29, 1938, the locomotive hauling a 14-axle train on the Leningrad–Moscow line reached a speed of 170 km/h, setting the absolute speed record for steam trains in the USSR.

Before World War II, railways faced increased competition from aviation and road transport in high-speed passenger transportation over distances of 300–600 km. The railway industry responded with high-speed diesel trains which were widespread, in particular, in Germany and the United States. In 1933, SVT 877 high-speed diesel trains capable of reaching speeds of up to 165 km/h were put into regular operation on the Berlin–Hamburg line in Germany [5].

In the United States, one of the first successful attempts to use an internal combustion engine for speed traffic was a diesel train under the brand name "Pioneer Zephyr"[8] which consisted of three articulated carriages on intermediate bogies. On May 26, 1934, the Pioneer Zephyr[9] (*Fig. 9*) travelled non-stop from Chicago to Denver (1,633 km) in 13 hours[10] at an average speed of 125.5 km/h, with a maximum recorded speed of 181.0 km/h [7].

Some countries, such as Sweden, Switzerland, Italy, Germany, and the USSR, increased the rates of railway electrification, expanded suburban transportation by electric trains around large cities, and created the first high-speed electric trains. On July 20, 1939, the ETR 200 electric multiple unit travelled along the Florence–Milan (314 km) line in Italy in 1 hour 55 minutes (average speed: 164 km/h) with a maximum speed of 202.8 km/h [6a] (*Fig. 10*).

After World War II, the rates of replacing steam locomotives with diesel ones increased in both freight and passenger traffic first in the United States and later in other countries. By the 1950s, U.S. railway companies had stopped electrification of railways and focused instead on diesel locomotive operations, which required less investment.

At the same time, along with the introduction of diesel locomotive traction, the electrification of railways continued in the USSR (which ranked second after the United States in terms of railway network length), the majority of European countries, and later in Japan, China, India and a number of other countries.

By the early 1970s, steam traction had almost totally disappeared from trunk railway lines in most of the leading industrial countries.

Fig. 9. American diesel trains of the 1930s. Zephyr [7]

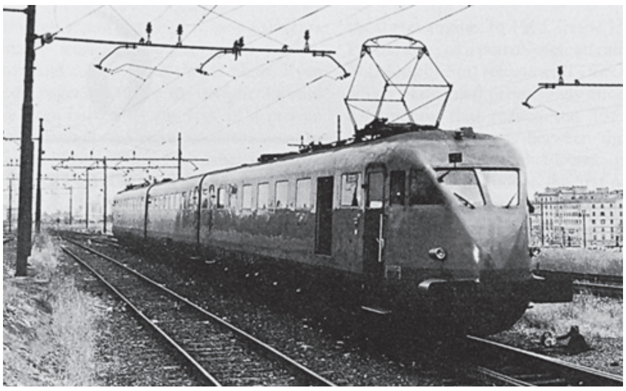


Fig. 10. ETR200 electric multiple unit. Italy. 1939 [7]

[8] The diesel train was named after American pioneers, or American settlers, of the 18th–19th centuries who travelled to western lands of the United States of America against the west wind. Zephyr (ancient Greek: Ζέφυρος) means "west wind".
[9] The diesel train was named after American pioneers, or American settlers, of the 18th–19th centuries who travelled to western lands of the United States of America against the west wind. Zephyr (ancient Greek: Ζέφυρος) means "west wind".
[10] According to a schedule, an express train with a steam locomotive travelled this route in 27 hours.

Fig. 11. Le Capitole express train between Paris and Toulouse – Europe's first train with a maximum speed of 200 km/h. Early 1960s [7]

Significant progress in high-speed railway traffic was achieved by France, where a train exceeded the 300 km/h mark in test runs in 1955. The CC 7107 and BB 9004 DC electric locomotives, each hauling a train of three carriages with a total weight of 111 tonnes, achieved speeds of 325 km/h and 331 km/h, respectively. In the early 1960s, on a number of railway lines in France, regular trains reached speeds of up to 200 km/h (*Fig. 11*).

In the post-war period, the USSR implemented an unprecedented General Plan for retrofitting the railway industry on the basis of electrification. In the 1960s, the progress in high-speed traffic achieved on the October Railway was comparable to the performance of high-speed express trains on railways of Japan, France, Italy, the United States, and other countries leading the way in this field. At that time, the Moscow–Leningrad line was on par with the best foreign rail lines in terms of travel speeds of passenger trains — and this was over a 650 km long route, which was two or three times longer than most of the railway lines abroad. In March 1966, a train with a ChS2M electric locomotive running on a block section on the Leningrad–Moscow line achieved a speed of 200 km/h for the first time in the history of Russia [8].

The process of railway speed increase before the emergence of dedicated high-speed lines is divided into three periods. The periodization is based on the two interrelating parameters: the record train speed and the maximum speed in commercial service. Period 1 — from the beginning to the middle of the 19th century — involved building the first high-speed (also known as "racing") steam engines[11]. Period 2 — from the mid-19th century to the first decades of the 20th century — saw consistent increases in speeds of the best trains to 120–150 km/h, the beginning of competition of railways with air and road transport, and the end of the steam traction era after reaching its peak at the speed of 200 km/h. Period 3 — between the 1930s and the mid-1960s[12] — marked the switch to internal combustion engines and electric traction in high-speed traffic and the achievement of speeds of up to 200 km/h in commercial service. The current Period 4 (which started in the mid-1960s) involves the creation and development of dedicated high-speed rail lines [6a].

HIGH-SPEED RAIL

In 1964, a historic event that opened a new page in the development of railway transport took place in Japan when the world's first dedicated high-speed rail service for passengers was launched between Tokyo and Osaka. It was 515 km long and was designed for regular traffic of trains with a maximum speed of over 210 km/h (*Fig. 12*). In terms of importance and consequences, this is comparable to opening of the first intercity public railway, the Stockton and Darlington Railway, in England in 1825. The concept of *"dedicated high-speed rail"* was established. First, the world widely used the term *"Shinkansen"*[13]. The acronyms "VSM" (for "high-speed main line") or "VSZhM" (for "high-speed railway line") have become entrenched in the Russian language.

a

b

Fig. 12. *a* – 0 (Zero-kei) series train – the world's first bullet train. Japan, 1964. Igor P. Kiselev's collection; *b* – Commercially available modern, newest E7 high-speed train, Japan. Tokyo Station. 2015. Photo by Igor P. Kiselev

[11] Some studies mention "the first intoxication of mankind with speed". Record-breaking rides achieved speeds of over 100 mph, after which interest in speed steam locomotives faded.
[12] This includes the period of World War II and first post-war decade which saw a large decrease in travel speeds.
[13] In Japanese, "shinkansen" means "new trunk line" or "new main line".

With the opening of the first HSR, the original paradigm of the high-speed railway transport has notably changed. Unlike most railways, HSR in its modern format includes purely dedicated passenger routes for large-scale services within strictly defined transport corridors. Before that, train traffic of various purposes and at various speeds — fast express passenger trains, ordinary long-distance passenger trains, suburban and freight trains — predominantly used the same (all-purpose) railway tracks. On rare occasions, usually in the vicinity of very large metropolitan cities, dedicated tracks were provided for suburban traffic. Dedicated freight rail lines were also created for large flows of homogenous goods, such as coal, ore, other minerals, timber, etc.

High-speed rail laid the foundation for large-scale passenger transportation, initially at speeds of over 200 km/h and currently of up to 350 km/h with high levels of comfort and safety on shuttle routes between stations with high passenger flow generation. HSR using trains with seating coaches occupy a transport niche for distances of up to 600–800 km with an optimal travel time of about 2–2.5 hours.

"High-speed rail" is a historically developed, conventional concept. It is based on conventions and regulations, as there is no real-world boundary defining the speeds for "high-speed" rail traffic, as opposed to, for instance, the concept of "sound barrier" in aviation. In the first decades of the 20th century, "high-speed" rail traffic referred to the movement at a speed of 140–160 km/h, and by the end of the century, it meant travelling at a speed of up to 200–250 km/h [7].

According to the UIC materials distributed at the 12th World Congress on High-Speed Rail in Beijing on July 8–11, 2025 [9], high-speed rail (HSR) lines are "integral, integrated systems" with infrastructures for speeds of 250 km/h and above, modernized lines for speeds of up to 200 km/h, specially designed rolling stock, telecommunications and signalling systems without floor signals where train control data is communicated directly to the driver's cabin, and certain operating conditions are met [10]. These lines are usually used on shuttle routes.

In Russia, Federal Law No. 4483-FZ dated November 30, 2024 "On Amending Federal Law "On Railway Transport in the Russian Federation"" describes high-speed rail transport as commercial transportation at speeds of over 200 km/h. The same law defines high-speed railway rolling stock as "railway rolling stock designed for carrying passengers and/or luggage, and mail at speeds of over 200 km/h" [11].

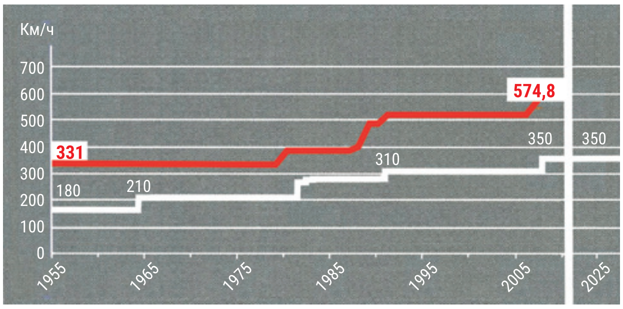


Fig. 13. Growth of record speed (red line) and speed of trains |in commercial service (white line) on HSR lines worldwide (1955–2015). Diagram prepared by Igor P. Kiselev; source: [8, p. 10]

Between 1955, when the first Tokyo–Osaka HSR was built in Japan, and present, the registered record train speed on classic railways (wheel-rail system) has increased from 331 km/h[14] to 574.8 km/h (the V150 experimental train, France, April 3, 2007).

By now, the maximum speed of trains in regular service has increased from 210 km/h (Tokyo–Osaka, 1964) to 350 km/h on several HSR lines. No high-speed line in the world operates commercially at higher speeds[15] (*Fig. 13*).

Figuratively speaking, there is no market product called "high-speed railway and its rolling stock for commercial service at a speed of 400 km/h" in the world today.

At present, more than 64,400 km of specially built high-speed rail lines are in operation [8, p. 29], more than 20,000 km are under construction, about 20,000 km are being designed, and in the long run it is planned to build about 34,000 km more. The longest HSR lines are available in the following countries: China — 48,000 km [12]; Spain — 3,990 km; Japan — 3,140 km; France — 2,730 km; Germany — 1,630 km; Turkey — 1,230 km; Italy — 980 km; Republic of Korea — 870 km; Saudi Arabia — 440 km; Belgium — 200 km; Morocco — 180 km; Switzerland — 170 km; the United Kingdom — 110 km; the Netherlands — 90 km; Denmark — 56 km [13].

12TH WORLD CONGRESS ON HIGH-SPEED RAIL: REVIEW OF THE FIRST QUARTER OF THE 21ST CENTURY, AND PROSPECTS

The 2025 Congress was held in the giant China National Convention Centre in Beijing. It brought together about 2,000 participants: representatives of more than

[14] In France, an experimental train with an electric locomotive BB 9004 reached a speed of 331 km/h on March 29, 1955.
[15] According to media sources, trains with a design speed of 360 km/h are planned to operate on several sections of the existing high-speed railways in Italy and France. The High Speed 2 (HS2) London–Midlands line in the UK, which has been under construction since 2019, is designed for a maximum speed of 360 km/h.

Fig. 14. Congress meeting hall. Photo credit: UIC

Fig. 15. Roundtable session "Innovation for a Better Life". Photo by O. Nazarov

40 countries and employees of the Chinese railways, railway industry companies, scientists, employees of research and design organizations, professors and students of higher educational institutions in the field of railways (*Fig. 14*).

In his welcoming address to the congress participants, Vice Premier of the State Council of the PRC Zhang Guoqing noted that China was ready to share their achievements in the field of high-speed railways with other countries. According to him, by 2024, the length of high-speed railways in China reached 48,000 km, which is more than 70% of the total length of HSR worldwide.

At the opening ceremony, welcoming remarks were also made by President of the International Union of Railways Alan Beroud, President of China Railways Corporation Song Xiude, high-ranking representatives from Kyrgyzstan, Laos, Uzbekistan, Mongolia, and other countries.

The Congress included plenary sessions with panel discussions (*Fig. 15–17*), roundtables, and 30 break-out sessions where about 180 presentations were made by speakers from 26 countries. The reports were selected by an expert research team of the Congress Organizing Committee from among a few hundreds of proposals received from many countries from those willing to take part in scientific discussions at the Congress.

The largest number of presentations (62) was delivered by scientists from the People's Republic of China. We believe that the number of reports made at the Congress shows the interest of the research and transport communities of a certain country in HSR issues, which is related to success in the implementation of HSR projects. Representatives of China were first with 62 presentations; Italy was second with 26 presentations, followed by Spain and France with 11 presentations each; Germany delivered 9 presentations; Japan made 6 presentations; the United Kingdom, Morocco and Poland of-

Fig. 16. Break-out session "Developing HSR network and stations". From left to right: Session moderator: Liu Lihai, Deputy Chief Engineer, China Railway, Siyuan Survey and Design Group Co., Ltd, China; Saad El Marzouki, Head of Production Department, TGV Office National des Chemins de Fer (ONCF), Morocco; Aleksandar Dobrijevic, Deputy Director, Institute of Traffic and Transport Ljubljana, member of SEESARI Institute of Traffic and Transport Ljubljana and SEESARI (Initiative for supporting rail and transport development in South East Europe), Slovenia; Zhou Lingyun, Head of Department, China Academy of Railway Sciences (CARS), China; Igor Kiselev, Professor, Emperor Alexander I St. Petersburg State Transport University, Russian Federation; Graham Nelmes, General Manager, Customer, Place and Operations, High Speed Rail Authority, Australia. Photo by O. Nazarov

Fig. 17. In the meeting room of the break-out session "Developing HSR network and stations". Photo credit: UIC

fered 3 presentations each; Australia, Switzerland and the Republic of Korea were represented by 2 speakers each; and the other countries represented in scientific discussions (Belgium, Bulgaria, Iran, Canada, Norway, Peru, Russia, Saudi Arabia, Slovenia, the United States, Finland, and Sweden) each had one speaker.

As was mentioned above, the Congress had six parallel break-out sessions, each broken into five sub-sessions. Thus, there were in total 30 sessions with the topics that, according to the Congress organizers, outlined a range of relevant scientific, engineering, financial, economic, social, environmental and other issues in the development of high-speed rail transport.

The themes of the Congress sessions were as follows:

1. Artificial Intelligence and Digital Innovation.
2. Infrastructure and Superstructure.
3. Socio-Economics, Environment and Commercial.
4. Rolling Stock and New System Performance.
5. System Operations and Passenger Experience.
6. Network Development and Stations.

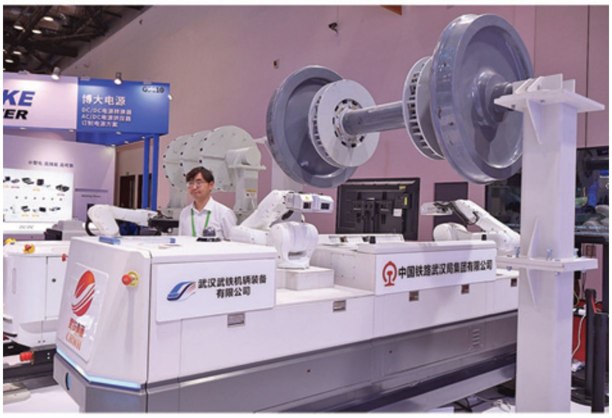
The author is planning to use the materials (speaker papers and presentations) published by the Congress Organizing Committee to review the current academic and engineering areas of research in the field of high-speed rail that were considered by professionals from different countries and presented at the Congress for publication.

The Congress participants reviewed important areas of academic, engineering, design and organizational activities for the design, construction and operation of high-speed rail lines. In particular, they touched upon the issues of using artificial intelligence technology and digital innovation, improvement of the infrastructure, rolling stock development; socio-economic, environmental and commercial aspects of HSR; improvement of control systems and provision of safety, operation and passenger services; development of HSR networks, stations, and many more. Interestingly, the subject of magnetic levitation transport has currently lost its relevance, although some participants still mentioned it in their presentations. Besides, a driving trailer of a Chinese maglev train was demonstrated at the exhibition.

The 17th China International Modern Railway Technology and Equipment Expo which attracted 521 participants from 14 countries was held simultaneously with the Congress in the same giant complex of buildings of the Beijing National Congress Centre (*Fig. 18*). The exhibition area was about 49,000 sq. m (the size of more than five football pitches[16]) [14, 15].

The exhibition regularly held every two years is organized by the Chinese Academy of Railway Sciences and the China World Trade Centre in coordination with the Ministry of Commerce of the PRC and China State Railways. The majority of participants are Chinese companies; however, many world leading rolling stock

a


b

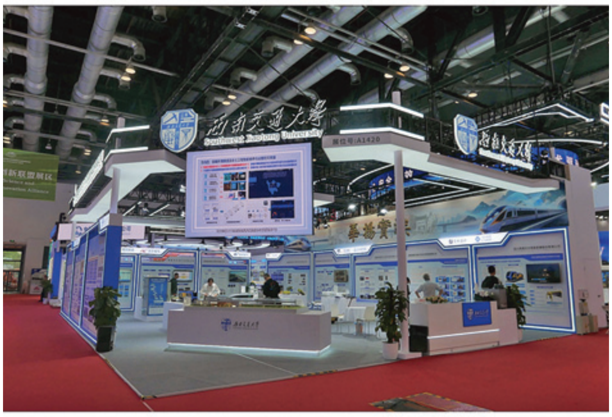

c

Fig. 18. The 17th China International Modern Railway Technology and Equipment Expo: *a* – Stand of China Railway Rolling Stock Corporation (CRRC). Photo by the author; *b* – Robotic installation for comprehensive testing of wheel sets at the Wuhan Locomotive Plant; *c* – Stand of the Southwest Railway University. Photo by the author

[16] According to the accepted average parameters, the "ideal" football pitch for a game between two teams of 11 players each should be 105 m by 68 m, with the area being 7,140 sq. m.

Fig. 19. General view of the exhibition on the test ring tracks of the National Railway Testing Centre of the Chinese Railway Academy. Photo by the author

Fig. 20. China's new CQS-300 ballast cleaning machine intended for operations on turnouts with 4,800 mm reinforced concrete turnout sleepers. Photo by the author

and railway equipment manufacturers and design organizations present their products at the exhibition.

On one of the Congress days, the participants were introduced to activities of the National Railway Testing Centre of the Chinese Academy of Railway Sciences located in a close suburb of Beijing in the northeast, outside the 5th Ring Road.

The Centre's test ring was designed and built with the involvement of professionals from the USSR in 1958. In terms of its basic engineering solutions, it looks like the experimental railway ring of the Railway Research Institute (VNIIZhT JSC) in Shcherbinka[17]; however the Chinese test ring has a large diameter and, hence, longer tracks, which makes it a good place for tests, even at high speeds. On April 18, 2023, a speed record of 222.2 km/h for a train running on the experimental ring was set there. This points to the vast opportunities for Chinese researchers and specialists in various experimental operations [16].

The Congress participants familiarized themselves with work of several laboratories of the Centre, in particular, for brakes, current pickup, wheel set testing, and others.

LIGHTER AND FASTER

A few dozens of samples of railway equipment, including electric passenger trains intended for various purposes, locomotives, track machines, etc., were exhibited on the tracks of the Centre (*Fig. 1–23*). The strongest "attractors" were certainly the two latest

[17] https://wagon-cargo.ru/news/generalnyy-direktor-sergey-vinogradov-i-eksperty-ao-vniizht-stali-uchastnikami-vystavki-modern-railw/

Fig. 21. China's eight-carriage high-speed electric multiple unit for suburban and urban services with the design speed of 200 km/h. It can accommodate 1,592 passengers in seating. Photo by the author

Fig. 22. China's experimental CR450 AF high-speed electric multiple unit with the design speed of 450 km/h. You can clearly see the stamped three-dimensional silhouette of an arrow on the hull plating — an element of the train brand. Photo by the author

Fig. 23. China's experimental CR450 BF high-speed multiple unit with the design speed of 450 km/h. The designers' idea is that the nose fairing of the driving trailer should look like a falcon beak — an element of the train logo. Photo by the author

models of the CR450AF and CR450BF experimental trains "facing" each other on the first track.

Unfortunately, the Congress participants were allowed to see and take plenty of pictures of only the exterior of these beautiful trains. Exhibition participants are not allowed inside wagons, as the interior design has not been completed and some carriages have measuring and control equipment for tests on-board.

Since 2021, China has been implementing the CR450: Science and Technology Innovation Project (Chinese Railways 450 [km/h]), a national programme aimed to define key technologies for achieving train speeds of 400 km/h in commercial service [15]. As was noted above, today, there are no HSR lines and trains for them able to travel at a maximum speed of 400 km/h in regular traffic.

Attempts to create such trains and infrastructures were previously made in the Republic of Korea (South Korea) and Japan. In 2007–2013, the Republic of Korea carried out a project for the creation of the HEMU 430X[18], a train with the design speed of 430 km/h (and a maximum service speed of 400 km/h), and also planned to build a HSR line with these parameters. The project did not succeed and was closed in 2013 [17, 18].

In 2005–2009, Japan implemented a project that involved building two experimental trains, Fastech 360S and Fastech 360Z, which passed tests successfully. As a result, they were used as a basis for creating an experimental train E956 ALFA-X[19] with the design speed of 400 km/h. The project has been underway since 2016. Tests conducted in 2019 showed good results and a prototype of the E10 train is currently being manufactured. Its testing and commercialization are planned to take place before 2030 [19, 20].

Thus, China is the third country that has embarked on harnessing the speed of 400 km/h in commercial service. In China, the CR450 project has created prototype trains and elements of the new infrastructure, which, as Chinese experts put it, should ensure entering the "uncharted territory". What is meant is that a speed of up to 350 km/h has already been achieved in commercial service on classic high-speed rail (HSR) lines, and, as anticipated by scientists, the speed range of 450 km/h and higher is for magnetic suspension (maglev) transport.

The two prototype high-speed trains with the design speed of up to 450 km/h, CR450AF and CR450BF, presented at the exhibition were designed independently by two subsidiaries of CRRC[20], CRRC Changchun Rail-

[18] HEMU 430X (High Speed Electric Multiple Unit-430 eXperemental) is an experimental multiple unit electric train designed to achieve a maximum speed of 430 km/h.

[19] Advanced Labs for Frontline Activity in rail eXperimentation.

[20] 中国中车股份有限公司 CRRC Corporation Limited (China Railway Rolling Stock Corporation) is a Chinese corporation, the world's major manufacturer of railway rolling stock accounting for about one half of the global market.

way Vehicles and CRRC Sifang, using the same specifications developed by China Railway (CR).

The company used its own solutions, relying solely on Chinese technologies, to create the train. To date, these have been implemented in high-class trains CR400AF Fuxing (put into operation in 2016; more than 300 trains (the eight-carriage model) were manufactured) and CR400BF Fuxing (put into operation in 2016). The goal of the CR450 programme is to utilize the achievements of Chinese scientists and specialists in science and engineering to improve the characteristics and reach, first of all, the speed limit of 400/450 km/h.

The new trains combine all the state-of-the-art solutions in design and construction of high-speed rolling stock that have been achieved by Chinese scientists and specialists. As a result, according to CRRC, with the design speed of 450 km/h and a planned commercial service speed of 400 km/h, the total weight of the CR450 train is reduced by 10% compared to the previous production model, in particular, due to the use of 10% of carbon fibre-based elements in the train body.

The axle load is about 14.5 tonnes. The tractive resistance is 22% lower than in the CR400; the adhesion capacity is improved by 4%; the braking capacity is increased by 20%; and the emergency braking distance is less than 6,500 m. Power consumption at a speed of 400 km/h has been reduced by 20% to 22 kWh/km, and the noise levels are 2–4 dB lower — less than 68 dB in the central part of the carriage [15, 21, 22].

The train uses permanent magnet synchronous motors[21] and traction converter systems with water-based cooling solutions. While the CR450 has a higher total tractive power — 11,000 kW (against 9,600 or 10,400 kW in CR400 trains), its propulsion system sets have become lighter and more efficient by 2–3%.

Highly stable new generation bogies have been designed for the trains. To create them, nine modern technologies were developed, including an eddy-current brake and carbon ceramic brake disc.

Safety is provided by a multi-level emergency braking control system and more than 4,000 built-in sensors for continuous monitoring of critical units and components. The automatic system monitors the condition of the train's undercarriage, body, pantographs, propulsion equipment, train control, and fire-fighting systems in real time.

The CR450AF has successfully passed tests at a speed of over 420 km/h, with a maximum speed of 453 km/h. The tests were carried out on a section with a bridge across Meizhou Bay and a tunnel in Haiwei. The speed reached by the train while running on these artificial structures was 453 km/h and 420 km/h, respectively. Further tests are planned to be conducted, in particular, on a section of the Chengdu–Chongqing high-speed railway [23].

The section infrastructure is reconstructed, including the replacement with new elements that will enable movement at a speed of up to 400 km/h. These, in particular, include specially designed rail fastenings and turnouts, new so-called "flat welded rail bonds" — the barriers to reduce noise levels. Moreover, to provide traffic at new speed levels, the subgrade formation was improved to increase stability, and changes to the design of bridges and viaducts were made.

The prototypes of high-speed trains for the speed of 450 km/h were among the main attractions of the exhibition.

Like their predecessors, the new eight-carriage trains have four two-carriage sections, each consisting of a motor carriage and a trailer carriage. The end (control) trailers have a control cabin. The two-carriage section has a full set of necessary electric and pneumatic equipment. Pantographs are installed on the roof of the third and sixth carriages, and only one of them is used under the normal operation. The high-voltage cable that runs between carriages is installed in the ceiling void.

The layout, finishing and furnishing of passenger compartments of the new trains will rely on the high performance achieved when creating the previous series CR400AF Fuxing and CR400BF Fuxing that have been proven in operation by both experts and passengers.

Much effort in creating the new trains was focused on improving the aerodynamic properties of high-speed rolling stock, with air resistance being of primary importance. According to research data, at a speed of 300–350 km/h, up to 75% of the traction effort is spent to overcome the aerodynamic component of resistance to movement. At a speed of 400 km/h, resistance increases by another 30% and up to 95% of energy is spent to overcome air resistance [15, 22, 23].

According to media sources, a dedicated technical team of China Railway, which included employees of the Academy of Railway Sciences, the Faculty of Engineering Sciences at the University of the Chinese Academy of Sciences, the Institute of Mechanics of the Chinese Academy of Sciences, and several trans-

[21] Synchronous machines use permanent magnets to create and maintain the electromagnetic field of the rotor without consuming additional energy from the system. Permanent magnet synchronous motor (PMSM) is an electromagnetic motor with the inductor made of permanent magnets. Permanent magnet motors reduce energy loss in the system and do not require current to be applied to the exciting winding via the slip rings. These motors have 2–3% higher efficiency compared to high-performance asynchronous electric motors and dimensions that are 20–30% smaller with the same output.

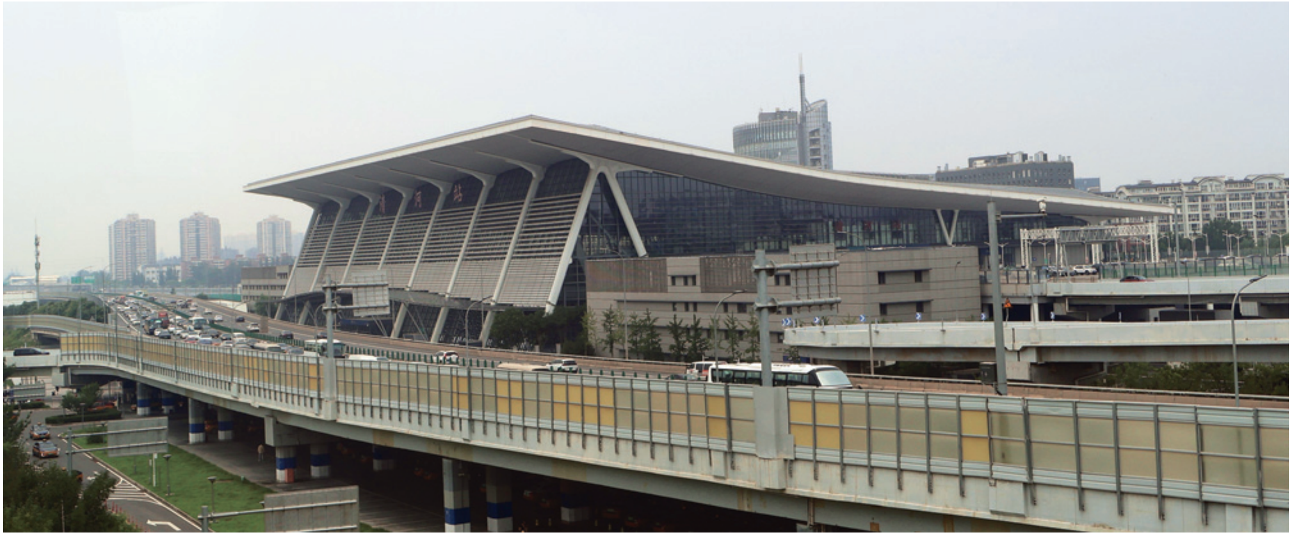


Fig. 24. Qinghe Station building, which is often referred as the West Railway Station of Beijing. Photo by the author

port universities, developed and proposed more than 100 shape design solutions for the nose of the driving trailers based on bionics. After hundreds of tests on mathematical models and wind tunnel experiments, two shape designs have been finally chosen for the nose: one shaped as a flying arrow for the CR450 AF (please see *Fig. 22*) and the other resembling a falcon beak for the CR450 BF. While the "flying arrow" is clearly distinguishable on the side view of the trailer, the "falcon beak" requires, in the author's opinion, a good deal of imagination to discern (please see *Fig. 23*).

According to executives of China Railway, a large set of tests are to be conducted before 2028 on both train prototypes and all the relevant infrastructure elements.

Back to the Congress, let us note that in the 40-degree heat that hit Beijing at the time, examining a variety of modern rail vehicles exhibited on the tracks of the Centre was quite a challenge for the participants, most of whom had photography equipment with them. In contrast, visiting the laboratory buildings to see very interesting equipment was much more relaxing as they are equipped with powerful air-conditioning systems which pumped icy-cold air into the rooms. But having gone through hardships, the Congress participants were rewarded with extremely interesting information about the current progress in railway science and technology in China.

FIRST-HAND EXPERIENCE

On the final day of the Congress, the participants had a technical visit to the facilities of two HSR stations (*Fig. 24*) and a ride on a CR400 BF high-speed train — one of the latest modifications of the rolling stock (design speed: 400 km/h; service speed: 350 km/h).

The CR400 AF and CR400 BF are currently the most used, most comfortable and the fastest trains on China's HSR network. The trains represent a concentration of Chinese brands: the resulting product developed by Chinese scientists and engineers, which formed the basis for the creation of the next generation of trains branded "Fuxing" (meaning "rejuvenation" in Chinese).

The CR400BF-GS 5337 (*Fig. 25*) provided to carry the Congress participants is an eight-carriage electric multiple unit (with four motor carriages and four trailer carriages with a total power of 10,400 kW) that can accommodate a maximum of 619 passengers. Based on the fleet number 5337 (according to the reference tables found online), the train was one of the ten EMUs manufactured by CRRC Changchun Railway Vehicles Co., Ltd in December 2024 and put into operation in January 2025. In total, 38 trains of this modi-

Fig. 25. The driving trailer of the CR400BF-GS 5337, which Congress participants travelled on. Photo by the author

Fig. 26. CR400BF high-speed train: *a* — Business Class coach interior with individual mechanized seats that are referred to as "eggshell" in China for the similar appearance of the cover. Passengers can set the seat in the "bed" position on their own using a remote control. Photo by the author; *b* and *c* — First Class coach interior. Passengers can turn the seats on their own to sit facing the engine. Photo by the author

fication were manufactured. This version of the train was structurally designed as more resistant to sand storms and cold climate for use in extreme weather conditions. Its design includes a number of the latest solutions that distinguish it favourably from the base model put into operation in 2016. We are referring to a new modular traction transformer and new electrical distribution cabinets. By improving the layout of the interior of coaches, the train's passenger carrying capacity was increased by 42 persons (38 second-class seats and 4 first-class seats). The CR400BF-GS train modification was further tested in 2024 [24].

The Congress participants examined the interior design of the coaches which are divided into three classes: Business (the top level of seating comfort in China): individual extra comfort seats with three seats in a row; First Class: four seats in a row (2+2); and Second (Economy) Class: five seats in a row (2+3).

Let us note that the designer of Russia's new high-speed train for the Moscow–St. Petersburg HSR is planning to use approximately the same classification of coaches. Let us recall, that second-class coaches of *the Sapsan* have four seats in a row, while the carriage width is the same as in China's trains intended for HSR. Seating arrangement with five seats in a row will, certainly, be rather cramped for Russians who are generally bigger. Perhaps, this will be compensated for by a lower fare.

On Chinese trains, passengers can visit a buffet carriage (*Fig. 27*), while business and first-class passengers are served food and drinks at their seats. The train has dedicated seats for passengers with reduced mobility provided with anchorage for securing wheelchairs.

The train has two types of sanitary facilities: the "European" type, which is customary to us, and so-called "Eastern toilets" when a flat toilet is built into the floor. There is also a dedicated toilet for people with disabilities.

During the trip, Russian participants conducted an experiment to verify that the train was moving very smoothly thanks to its design and the perfect condition of the track. China's media like to describe the experiment in their reports about HSR. We repeated the test

Fig. 27. Buffet counter. Photo by the author

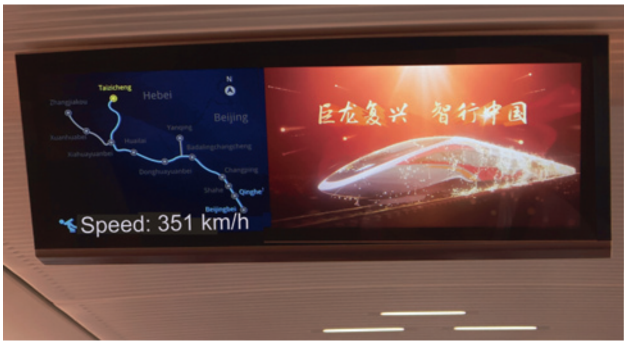


Fig. 28. Information board in the passenger compartment of the CR400BF train showing the current speed of 351 km/h

Fig. 29. The coin standing still on its edge at a speed of 350 km/h

several times and testify to its success. When the train ran at a speed of about 350 km/h (as was seen on the information board (*Fig. 28*)), we put a coin on its edge on the window sill (*Fig. 29*). The coin stood still as long as the train travelled in a straight line. When it began to brake, the coin naturally started to roll.

It took the train 55 minutes to travel about 190 km from Qinghe Station, which is often referred to as the Western Railway Station of Beijing, to Taizicheng Station, developing a speed of up to 350 km/h on several sections.

Two kilometres from Taizicheng Station (*Fig. 30*), there is the Olympic Village of the 2022 Winter Olympics, which is located at an altitude of 1,582 m above the sea level (*Fig. 31*). Very close to the neighbouring Badaling Station, you find the cyclopean structures of the Great Wall. All this makes the route of the Beijing–Chongli high-speed railway quite popular with tourists.

WHAT'S THE BOTTOM LINE?

In general, the 12th World Congress on High-Speed Rail was a special event for China's railways.

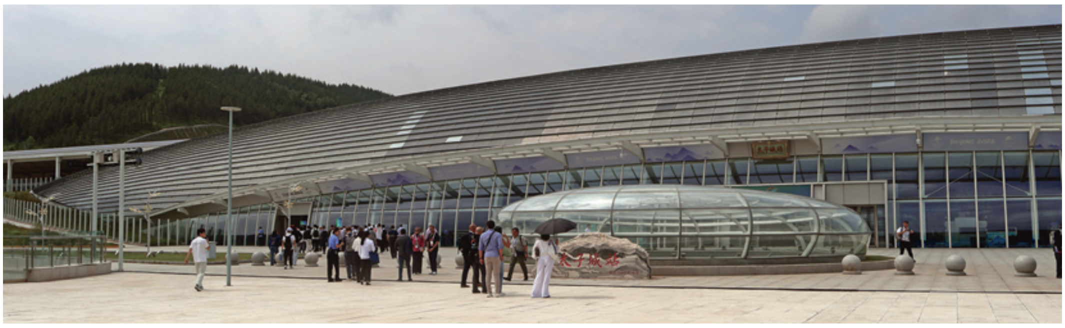


Fig. 30. Taizicheng Station building at an altitude of 1,582 m above the sea level close to the Olympic Village of the 2022 Winter Olympics. Photo by the author

Fig. 31. Olympic Village of the 2022 Winter Olympics

China presented its ambitious programme for expanding the HSR network and increasing train speeds. By the end of 2025, the length of China's HSR network will exceed 50,000 km, and by the end of 2035, China Railway plans to expand the HSR network to 70,000 km and increase the maximum commercial operating speed to 400 km/h, President of China Railway (CR) Xiude Song reported. This will make the Chinese network the fastest in the world. It is planned to create eight so-called "vertical" and eight "horizontal" lines (*Fig. 32*). By now, about 80% of the planned network has been completed; and the work is ongoing [25, 26].

In China, high-speed trains serve about 97% of cities with a population of above 500,000 people. More than 10,000 high-speed trains currently run in China, carrying 16 million passengers per year, Xiude Song said.

China is planning to expand, both literally and figuratively, the boundaries of its high-speed transport. The projects that are implemented under the leadership of China in Laos, Indonesia, Hungary, and Serbia were presented during the Congress. Senior officials from Kyrgyzstan, Mongolia, and Uzbekistan, where China also plans to contribute to the construction of high-speed railways, gave addresses at the opening ceremony.

According to Vice-Premier of the State Council of China Zhang Guoqing, in the early days of high-speed network development in the 2000s, the industry was

Fig. 32. Prospective plan of high-speed rail lines in PRC "Eight vertical and eight horizontal" lines as part of the Middle- and Long-Term Railway Development Plan in PCR (2016–2025 Development Period) published by the National Development and Reform Commission of the PRC, the Ministry of Transport of the PRC, and China State Railway on July 16, 2016 [25, 26]. Plan adapted by Igor P. Kiselev. Source: [27] In the diagram, the names of the "horizontal" lines are outlined in gray, and the names of the "vertical" lines are outlined in green

dependent on foreign suppliers, but China has fully mastered key technologies in the construction, manufacturing of equipment for, and operation of high-speed railways. "We have quickly made up ground and we are keeping abreast of the schedule, and now we are even ready to become world leaders", he said.

To sum up the outcomes of the Congress, let us note the following. The most important thing is that high-speed rail transport has utterly moved from experiments to regular daily use available to the general public in many countries. HSR lines confidently occupy a transport niche within a range of distances of up to 800–1000 km with maximum speeds of up to 350 km/h and travel times of 2.5–4 hours.

In addition to the above, Chinese railwaymen have tapped another transport niche: passenger services at speeds of 250–350 km/h over a distance of about 1,000 km on high-speed trains with sleeper coaches with four-berth compartments.

There are more and more regions that set out to build and expand high-speed rail. The emerging economies and middle-income countries are active with updating their maps of future high-speed railways, which shows that the transition from demonstration to implementation is in full swing. Investments in high-speed railways are no longer limited to those countries that have developed them earlier but are gaining global momentum with lots of points of entry and a growing exchange of knowledge, standards, and best practices.

The Congress has also shown that innovations in the field of high-speed rail are no longer limited to trains and tracks, but also encompass systems and services. An integrated ticketing system, AI-powered automated services, low-carbon construction technology, intermodal connectivity, and passenger-centric design of stations — all this shapes the next generation of railway transport.

The high-speed rail sector is moving from the narrow focus on speed to a broader approach focused on intelligent, efficient and user-friendly transport systems, turning high-speed rail into a platform for seamless and inclusive mobility. Many sessions at the Congress were focused on how to implement the transition by means of data exchange, open standards, and cooperation across the entire transport chain [28].

The Congress has definitely served as a global platform to showcase achievements in the field of high-speed rail and to promote technology exchange and industrial cooperation.

A number of countries, such as Japan, Spain, France, and Germany, have reached the point of saturation with high-speed rail services in their transport systems and therefore, naturally, they are reducing construction of new high-speed lines. China with its plans to build new HSR lines in 15–20 years to come will also reach this limit soon. The plans will, perhaps, be adjusted when a new range of speeds is achieved. As mentioned above, China is testing prospective trains with a design speed of 450 km/h and service speed of 400 km/h.

A common important trend in the railway industry worth mentioning is the growing robotics in many operation and maintenance activities. Both presentations and the exhibition presented ideas and ready-to-use solutions for these systems.

The Congress organizers promised to send all the presentations to the participants in September 2025. It is certainly very important to study the event proceedings, especially for those countries that have set out to implement their high-speed rail programmes in practice.

REFERENCES

1. Münster Sebastian Cosmographiae uniuersalis lib. VI. in quibus, iuxta certioris fidei scriptorum traditionem describuntur, omniu[m] habitabilis orbis partiu[m] situs, p[ro]priæq[ue] dotes. regionum topographicæ effigies.: Basileæ, 1550 / *Cosmographiae uniuersalis lib. VI. in quibus, iuxta certioris fidei scriptorum traditionem describuntur, omniu[m] habitabilis orbis partiu[m] situs, p[ro] priæq[ue] dotes. regionum topographicæ effigies: Münster, Sebastian, 1489–1552*. Free Download, Borrow, and Streaming: Internet Archive.

2. *The Oxford Companion to British Railway History 1603–1990s*. Ed. by Jack Simmons & Gordon Biddle. Oxford University Press, 1997. 592 p.

3. *Stephenson's Rocket. Science Museum Group*. URL: https://www.scienceandindustrymuseum.org.uk/what-was-on/stephensons-rocket

4. Sokolova S.A. Increasing the Speed of Railways (Before the mid-19th century). History of Mechanical Engineering. *Proceedings of the Institute of History of Natural Science and Technology of the USSR*. Moscow: Publishing house of USSR Academy of Sciences, 1962;45.

5. Speed and High-Speed Rail Transport: Two Volumes. St. Petersburg: Vybor, 2001;1.

6. The Pioneer Zephyr (1934). URL: https://corvidsketcher.com/2022/10/20/the-pioneer-zephyr-1934/.

7. High-Speed Rail. General course: Study guide for railway university students. Kiselev I.P., Blazhko L.S., Bryn M.Ya. et al. Two Volumes. 2nd edition, revised and supplemented. Moscow, 2020;1.

8. Valinsky O.S., Kiselev I.P. Scientific support for the design and construction of high-speed rail lines. Timeline of developing competencies for high-speed rail in Russia. *Transport of the Russian Federation*. 2024;1(110):9-27.

9. High-speed worldwide. Historical, geographical and technological developments. UIC. Paris, 2025. 87 p.

10. High-Speed rail. Intercity and High-Speed. UIC. URL: https://uic.org/passenger/highspeed/.

11. Federal Law No. 448-FZ dated November 30, 2024 "On Amending Federal Law 'On railway transport in the Russian Federation. Kontur Normativ. URL: https://normativ.kontur.ru/document?moduleId=1&documentId=483303.

12. (Daily science and technology newspaper, January 03, 2025). URL: http://www.china-railway.com.cn/xwzx/mtjj/kjrb/202501/t20250103_140450.html.

13. High Speed Lines in the World 2023 (Summary). Updated 1st December 2024. URL: https://uic.org/IMG/pdf/20250618_high-speed_lines_summary.pdf

14. Modern railway 2025. Exhibition Guide. July 8–10, 2025.

15. 全球最快高铁列车来了！CR450动车组样车发布 央视新闻 | 2024年12月29日 11:21:29 [The world's fastest high-speed rail train is coming! CR450 EMU sample car released CCTV News | December 29, 2024 11:21:2]. URL: https://news.cctv.com/2024/12/29/ARTIbTSmXsQ0YrvKXrZ6vjiM241229.shtml

16. 国家铁道试验中心环行线刷新试验速度纪录 发布时间：2023-04-19来源 [National Railway Test Centre Loop Line Refresh Test Speed Record Release Time] 2023-04-19. URL: https://www.chnrailway.com/index/shows?catid=10&id=4302

17. 단독] 시속 400km 초고속열차 도입 본격화…내년 초 마스터플랜 수립 [400 km per hour Super-fast train introduction in full swing...]. URL: https://biz.heraldcorp.com/article/2318720.

18. 최고시속 430km '해무' 타보니…"빠르고 안락하네". [Top speed: 430 km/h: Riding HEMU-430x… "Fast and comfortable"]. URL: https://www.yna.co.kr/view/AKR20160406123800017.

19. 次世代新幹線プロジェクトALFA-X [Next Generation Shinkansen Project ALFA-X] 2019. URL: https://www.jreast.co.jp/recruit/career/special/future/alfa-x.html.

20. Alfa-X Shinkansen: The 400 km/h Bullet Train 2020. URL: https://www.jrailpass.com/blog/alfa-x-shinkansen-bullet-train.

21. 时速400公里！全球最快高铁列车亮相. [400 kilometres per hour! The world's fastest high-speed train in the world is debuting]. URL: https://www.zsnews.cn/news/index/view/cateid/37/id/743775.html.

22. 时速400公里！全球最快高铁列车亮相. [400 kilometres per hour! The world's fastest high-speed train unveiled. Zhu Yan, Deputy Chief Engineer at CRRC Changke Co., Ltd., the manufacturer of the CR450BF]. URL: https://www.gov.cn/yaowen/liebiao/202412/content_6995225.htm.

23. 全球最快、跑出全新试验速度 中国高铁再次冲上热搜 全球最快、跑出全新试验速度 中国高铁再次冲上热搜 [The world's fastest and new test speed, China's high-speed rail once again rushed to the hot search] 2025-07-10. URL: https://content-static.cctvnews.cctv.com/snow-book/index.html?item_id=656653501519206742.

24. *CR400BF-GS China EMU*. URL: https://www.china-emu.cn/Trains/Model/Detail-13123-101-S.html.

25. 中国"八纵八横"高速铁路网 [China's "eight vertical and eight horizontal" high-speed railway network]. URL: https://baike.baidu.com/item/%E4%B8%AD%E5%9B%BD%E2%80%9C%E5%85%AB%E7%BA%B5%E5%85%AB%E6%A8%AA%E2%80%9D%E9%AB%98%E9%80%9F%E9%93%81%E8%B7%AF%E7%BD%91/23742590

26. 八纵八横"高铁网主通道建成投产约八成. 2024-10-02 [About 80% of the main channels of the "eight vertical and eight horizontal" high-speed rail network have been completed and put into operation]. URL: https://www.gov.cn/yaowen/liebiao/202410/content_6978094.htm

27. 中国高铁"八纵八横"规划图。（"当代中国"制图）. [China's "eight vertical and eight horizontal" high-speed railway network plan. (Map by "Modern China"]. URL: https://www.ourchinastory.com/cn/8366/%E4%B8%80%E6%96%87%E7%9C%8B%E6%B8%85%E4%B8%AD%E5%9B%BD%E2%80%9C%E5%85%AB%E7%BA%B5%E5%85%AB%E6%A8%AA%E2%80%9D%E9%AB%98%E9%93%81%E7%BD%91%E7%BB%9C

28. *From vision to execution: Reflecting on the 12th UIC World Congress on High-Speed Rail. UIC*. URL: https://uic.org/com/enews/article/from-vision-to-execution-reflecting-on-the-12th-uic-world-congress-on-high.

ЛИТЕРАТУРА

1. *Münster S.* Cosmographiae uniuersalis lib. VI. in quibus, iuxta certioris fidei scriptorum traditionem describuntur, omniu[m] habitabilis orbis partiu[m] situs, p[ro]priæq[ue] dotes. regionum topographicæ effigies.: Basileæ, 1550 / Cosmographiae uniuersalis lib. VI. in quibus, iuxta certioris fidei scriptorum traditionem describuntur, omniu[m] habitabilis orbis partiu[m] situs, p[ro]priæq[ue] dotes. regionum topographicæ effigies: Münster, Sebastian, 1489–1552: Free Download, Borrow, and Streaming : Internet Archive.

2. The Oxford Companion to British Railway History 1603–1990s. / Ed. by Jack Simmons & Gordon Biddle. Oxford University Press, 1997. 592 p.

3. Stephenson's Rocket. Science Museum Group. URL: https://www.scienceandindustrymuseum.org.uk/what-was-on/stephensons-rocket

4. *Соколова С.А.* Повышение скоростей движения на железных дорогах (до середины XIX века). История машиностроения // Труды Ин-та истории естествознания и техники Акад. наук СССР. Т. 45. М.: Изд-во Акад. наук СССР, 1962.

5. Скоростной и высокоскоростной железнодорожный транспорт: в 2 т. Т. 1. СПб.: Выбор, 2001.

6. The Pioneer Zephyr (1934). URL: https://corvidsketcher.com/2022/10/20/the-pioneer-zephyr-1934/.

7. Высокоскоростной железнодорожный транспорт. Общий курс: учеб. пособие для студентов вузов железнодорожного транспорта / И.П. Киселев, Л.С. Блажко, М.Я. Брынь и др.: в 2 т. 2-е изд., перераб. и доп. Т. 1. М., 2020.

8. *Валинский О.С., Киселев И.П.* Научное обеспечение проектирования и строительства высокоскоростных железнодорожных магистралей. Хроника развития компетенций высокоскоростного железнодорожного транспорта в России // Транспорт РФ. 2024. № 1 (110), С. 9–27.

9. High-speed worldwide. Historical, geographical and technological developments. UIC. Paris, 2025. 87 p.

10. High-Speed rail. Intercity and High-Speed. UIC. URL: https://uic.org/passenger/highspeed/.

11. Federal Law No. 448-FZ dated November 30, 2024 "On Amending Federal Law 'On railway transport in the Russian Federation. Kontur Normativ. URL: https://normativ.kontur.ru/document?moduleId=1&documentId=483303.

12. 技日报：旅客、货物发送量等指标均创历史新高 我国铁路高质量发展交出亮眼成绩单 发布时间：2025-01-03 (Ежедневная научно-техническая газета. 3 января 2025). URL: http://www.china-railway.com.cn/xwzx/mtjj/kjrb/202501/t20250103_140450.html.

13. High Speed Lines in the World 2023 (Summary). Updated 1st December 2024. URL: https://uic.org/IMG/pdf/20250618_high-speed_lines_summary.pdf.

14. Modern railway 2025. Exhibition Guide. July 8–10, 2025.

15. 全球最快高铁列车来了！CR450动车组样车发布 央视新闻 | 2024年12月29日 11:21:29 [Приближается самый быстрый в мире скоростной железнодорожный поезд! Выпущен прототип мотор-вагонного электропоезда CR450 EMU Новости CCTV | 29 декабря] [The world's fastest high-speed rail train is coming! CR450 EMU sample car released CCTV News | December 29, 2024 11:21:2]. URL: https://news.cctv.com/2024/12/29/ARTIbTSmXsQ0YrvKXrZ6vjiM241229.shtml

16. 国家铁道试验中心环行线刷新试验速度纪录 发布时间：2023-04-19来源 [Кольцевая линия Национального испытательного центра железных дорог побила новый рекорд скорости испытаний] [National Railway Test Center Loop Line Refresh Test Speed Record Release Time] 2023-04-19. URL: https://www.chnrailway.com/index/shows?catid=10&id=4302

17. 단독] 시속 400㎞ 초고속열차 도입 본격화…내년 초 마스터플랜 수립 [Полным ходом идет внедрение сверхскоростного поезда со скоростью 400 км в час...] [400 km per hour Super-fast train introduction in full swing...]. URL: https://biz.heraldcorp.com/article/2318720

18. 최고시속 430㎞ '해무' 타보니…"빠르고 안락하네" [Максимальная скорость — 430 км/ч. "Haemu" Табони... «Быстро и комфортно»]. URL: https://www.yna.co.kr/view/AKR20160406123800017

19. 次世代新幹線プロジェクトALFA-X [Проект Синкансэн нового поколения ALFA-X] [Next Generation Shinkansen Project ALFA-X] 2019. URL: https://www.jreast.co.jp/recruit/career/special/future/alfa-x.html

20. Alfa-X Shinkansen: The 400 km/h Bullet Train [Alfa-X Shinkansen: сверхскоростной поезд со скоростью 400 км/ч] 2020. URL: https://www.jrailpass.com/blog/alfa-x-shinkansen-bullet-train

21. 时速400公里！全球最快高铁列车亮相 [400 километров в час! Дебютирует самый быстрый в мире высокоскоростной поезд]. URL: https://www.zsnews.cn/news/index/view/cateid/37/id/743775.html

22. 时速400公里！全球最快高铁列车亮相 [400 километров в час! Представлен самый быстрый в мире высокоскоростной поезд. Чжу Янь, заместитель главного инженера компании CRRC Changke Co., Ltd., производителя электропоезда CR450BF]. URL: https://www.gov.cn/yaowen/liebiao/202412/content_6995225.htm

23. 全球最快、跑出全新试验速度 中国高铁再次冲上热搜 全球最快、跑出全新试验速度 中国高铁再次冲上热搜 [Китайская высокоскоростная железная дорога, ставшая самой быстрой и новой в мире в тестовом режиме, в очередной раз бросилась в горячие поиски] [The world's fastest and new test speed, China's high-speed rail once again rushed to the hot search] 2025-07-10. URL: https://content-static.cctvnews.cctv.com/snow-book/index.html?item_id=656653501519206742

24. CR400BF-GS ChanaEMU. URL: https://www.china-emu.cn/Trains/Model/Detail-13123-101-S.html

25. 中国"八纵八横"高速铁路网 [Китайская сеть высокоскоростных железных дорог «восемь вертикалей и восемь горизонталей»] [China's "eight vertical and eight horizontal" high-speed railway network]. URL: https://baike.baidu.com/item/%E4%B8%AD%E5%9B%BD%E2%80%9C%E5%85%AB%E7%BA%B5%E5%85%AB%E6%A8%AA%E2%80%9D%E9%AB%98%E9%80%9F%E9%93%81%E8%B7%AF%E7%BD%91/23742590

26. 八纵八横"高铁网主通道建成投产约八成. 2024-10-02 [Около 80% основных каналов высокоскоростной железнодорожной сети «восемь вертикальных и восемь горизонтальных» уже завершены и введены в эксплуатацию] [About 80% of the main channels of the "eight vertical and eight horizontal" high-speed rail network have been completed and put into operation]. URL: https://www.gov.cn/yaowen/liebiao/202410/content_6978094.htm

27. 中国高铁"八纵八横"规划图。（"当代中国"制图）[План строительства высокоскоростной железной дороги в Китае «Восемь вертикалей и восемь горизонталей». (Картография «Современного Китая»]. URL: https://www.ourchinastory.com/cn/8366/%E4%B8%80%E6%96%87%E7%9C%8B%E6%B8%85%E4%B8%AD%E5%9B%BD%E2%80%9C%E5%85%AB%E7%BA%B5%E5%85%AB%E6%A8%AA%E2%80%9D%E9%AB%98%E9%93%81%E7%BD%91%E7%BB%9C

28. From vision to execution: Reflecting on the 12th UIC World Congress on High-Speed Rail. UIC. URL: https://uic.org/com/enews/article/from-vision-to-execution-reflecting-on-the-12th-uic-world-congress-on-high

Bionotes

Igor P. Kiselev — Cand. Sci. (Philos.), Dr. Sci. (His.), Professor of the Department of "History, Philosophy, Political Science and Sociology", transport engineer; **Emperor Alexander I St. Petersburg State Transport University (PGUPS)**; Chief Science Editor; **Journal "BRICS Transport"**; 9 Moskovsky pr., St. Petersburg, 190031, Russian Federation; SPIN-code: 4347-9926, ID RSCI: 541415, Scopus: 57220864567; kis1347@mail.ru.

Об авторе

Игорь Павлович Киселев — кандидат философских наук, доктор исторических наук, профессор кафедры «История, философия, политология и социология», инженер путей сообщения; **Петербургский государственный университет путей сообщения Императора Александра I (ПГУПС)**; главный научный редактор; **журнал «Транспорт БРИКС»**; 190031, г. Санкт-Петербург, Московский пр., д. 9; главный научный редактор; SPIN-код: 4347-9926, РИНЦ ID: 541415, Scopus: 57220864567; kis1347@mail.ru.

The author declares no conflicts of interests.
Автор заявляет об отсутствии конфликта интересов.

The article was submitted 21.07.2025; accepted for publication 28.08.2025.
Статья поступила в редакцию 21.07.2025; принята к публикации 28.08.2025.