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XVI BRICS Summit in Kazan. The main results of transport issues consideration

XVI саммит БРИКС в Казани. Основные итоги

General photo of the BRICS summit participants in Kazan[1]

On October 22–24, 2024, the XVI BRICS Summit was held in Kazan as part of the Russian presidency of the BRICS in 2024, which had the motto "Strengthening multilateralism for equitable global development and security".

The summit was attended by most of the leaders (heads) of the BRICS member states: Russian President Vladimir Putin, Chinese President Xi Jinping, Indian Prime Minister Narendra Modi, South African President Cyril Ramaphosa, Egyptian President Abdul Fatah al-Sisi, Ethiopian Prime Minister Abiy Ahmed Ali and UAE President Muhammad bin Zayed Al Nahyan.

Out of the nine[2] BRICS members, two states were not represented at the summit by their top officials: Brazil was represented by Minister of Foreign Affairs Mauro Vieira (arrived instead of Brazilian President Lulla da Silva, who was injured shortly before the summit and participated in the summit via video link), the Iranian delegation was represented by President Masoud Peseshkian. Saudi Arabia was represented at the summit by Foreign Minister Faisal bin Farhan Al Saud, according to whom the Saudi side attended the meeting as an invited country[3]. Despite this, the organizers accepted Saudi Arabia as if it were a full member of the

[1] URL: https://rossaprimavera.ru/news/74bb6f23
[2] Ushakov: 13 countries are applying for BRICS partner status. Kommersant. URL: https://www.kommersant.ru/doc/7248901
[3] RPT Saudi's MbS will not attend Russia's BRICS summit URL: https://www.reuters.com/world/saudis-mbs-will-not-attend-russias-brics-summit-2024-10-10/

alliance, and the flag of Saudi Arabia was installed at the sites of the summit in Kazan along with the flags of other BRICS member states.

In total, representatives of 36 countries and six international organizations took part in the summit in Kazan. In addition to the delegations of the BRICS member countries, delegations from Afghanistan, Algeria, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Bolivia, Indonesia, Kazakhstan, Kyrgyzstan, Laos, Mauritania, Malaysia, Mongolia, Nicaragua, the Republic of the Congo, Republika Srpska, Serbia, Sri Lanka, the State of Palestine, Tajikistan, Thailand, Turkmenistan, Türkiye, Uzbekistan, Venezuela, Vietnam arrived in Kazan. The summit was attended by SCO Secretary General Zhang Ming, UN Secretary General Antonio Guterres, President of the New BRICS Development Bank Dilma Rousseff.

Special emphasis at the meetings and negotiations of the summit was placed on the intensification of economic cooperation and joint development in this area, to enhance the role of the BRICS countries in the international monetary and financial system and the development of independent interbank cooperation, in particular, through the expansion of settlements in national currencies. Considerable attention was paid to deepening cooperation in the fields of medicine, culture, science, education, sustainable development, artificial intelligence and digitalization. The summit participants paid great attention to the development of the transport industry.

The results of negotiations, conferences, and collective work at the summit were expressed in the BRICS declaration, a document adopted on behalf of the participating countries, which summarized the achieved[4]. According to the name of the host city, the declaration was named Kazan one.

At a press conference after the summit, Russian President Vladimir Putin described the document as follows: *"In our opinion, it turned out to be a comprehensive conceptual document with a positive agenda looking to the future. It is important that it confirms the commitment of all our states to building a more democratic, inclusive and multipolar world order based on international law and the UN Charter, and establishes a common determination to counteract the practice of applying illegitimate sanctions and attempts to undermine traditional moral values"*[5].

Thus, in the 83rd point of the Kazan Declaration, the participating countries reject unilateral discriminatory measures that do not comply with international law and purposefully destroy global production and logistics chains. Continuing this topic, the document separately notes the effectiveness of the special economic zones (SEZs) of the BRICS countries. They are an important well-established mechanism for trade and industrial cooperation and promotion of the development of the manufacturing sector, including high-tech sectors of the economy, information technology and services using them, tourism, as well as, in particular, port and transport infrastructure. In this regard, the creation of a Forum for Cooperation in the BRICS SEZ region was announced, as well as the launch of events aimed at exchanging practices and implementing standards and management techniques for these zones.

Among the main topics of the forum's discussions were the formation of a "green" economy issues. This has also been confirmed in the transport sector, namely in the discussion of ways to switch to environmentally friendly fuels. The 81st point of the Declaration states that the signatories declare the need to take into account the peculiarities of developing countries, whose economies largely depend on the sale or consumption of fossil fuels and related energy-intensive products. Otherwise, achieving a fair energy transition is impossible.

Chinese President Xi Jinping focused on environmental issues in his speech, noting: *"It is important to promote the BRICS green agenda in the name of sustainable development. Green development is the call of the times, and all BRICS member countries should actively integrate into the global trend of green and low — carbon transformation"*[6].

The principle of technological neutrality was supported at the forum. It involves the use of all available fuels, energy sources and technologies to reduce greenhouse gas emissions, including fossil fuels using emission reduction and capture technologies, biofuels, natural gas and liquefied petroleum gas, nuclear and renewable energy and hydrogen with its derivatives, including ammonia.

Point 92 is devoted to the development of transport, which notes: *"Developed transport infrastructure, safe, reliable and cost-effective international transport routes, innovative technologies and standards will contribute to the development of trade flows and cross-border movement of people, we recognize the importance of integrated use of various modes of transport to cre-*

[4] Kazan Declaration of BRICS. 2024. URL: https://cdn.brics-russia2024.ru/upload/docs/%D0%9A%D0%B0%D0%B7%D0%B0%D0%BD%D1%81%D0%BA%D0%B0%D1%8F_%D0%B4%D0%B5%D0%BA%D0%BB%D0%B0%D1%80%D0%B0%D1%86%D0%B8%D1%8F.pdf?1729693488382423

[5] Press conference following the XVI BRICS summit. URL: http://www.kremlin.ru/events/president/transcripts/75385

[6] Full text of Xi Jinping's speech at the 16th BRICS Leaders' Meeting on October 23, 2024. URL: https://russian.cgtn.com/news/2024-10-23/1849071761764814849/index.html

ate an efficient and sustainable transport system in the BRICS countries". Further, the participants refer to the first meeting of BRICS transport ministers, which took place in early summer of this year in St. Petersburg. The experience gained is planned to be used to further develop the transport dialogue between the BRICS countries, and most importantly, to create a logistics platform for coordinating and improving transport services in order to ensure multimodal logistics within the association.

The work of the BRICS Business Forum was noted in a separate, 129th point of the Kazan Declaration. In applied terms, it is engaged in the development of cooperation between large businesses, as well as small and medium-sized companies, including in the field of transport. Russian President Vladimir Putin mentioned this industry as very promising, explaining that increasing transport connectivity between the participating countries provides additional opportunities for growth and diversification of mutual trade. In this regard, a regular BRICS dialogue on this topic was launched this year, and subgroups on transport and logistics were formed within the framework of the Business Council. *"Promising projects such as the formation of a permanent BRICS logistics platform, the compilation of a review of transport routes, the opening of an electronic communication platform for transport, the establishment of a reinsurance pool are being discussed"*, the Russian leader added[7].

Sergei Katyrin, Chairman of the BRICS Business Council, President of the Russian Chamber of Commerce and Industry, spoke in more detail about the work of the Business Council within the framework of the forum: *"The main results of the forum and the proposals developed by the BRICS Business Council formed the basis of the annual report as the main result of our work for the year. In this document, we have included 46 recommendations for the further development of cooperation in the context of the main directions"*[8].

Transport and logistics were named among the first among them, since the great importance of transport development for the expansion of international trade is taken into account — the most important priority of the BRICS at the current stage. Sergei Katyrin clarified that serious attention in the work of the council was paid to the issues of strengthening transport and logistics interconnection, the development of international transport corridors, the development of modern intermodal logistics solutions and the creation of a seamless transport infrastructure.

Throughout 2024, during the BRICS presidency of the Russian Federation, hard work was carried out at various meetings and in the correspondence format of representatives of the BRICS transport community. They developed proposals to the leaders of the BRICS member countries on the development of the transport industry. As noted above, this work took place within the framework of the BRICS Business Council, with an organizational role during the presidency of the BRICS of the Russian Federation, the Chamber of Commerce and Industry of the Russian Federation. Within the framework of the working group on infrastructure of the BRICS Business Council, there was a subgroup on transport and logistics, coordinated by Russian Railways[9]. O.V. Belozerov, CEO and Chairman of the Board of Russian Railways, is the representative of the Russian Federation in the BRICS Business Council for 2022–2024[10].

The subgroup on Transport and Logistics met regularly, almost monthly, in the correspondence format of videoconferences, submitting for discussion of the various transport organizations of the BRICS countries the topical issues related to the development of transport cooperation.

On June 10–11, 2024, the III Conference of the Association of Rectors of BRICS Transport Universities was held in St. Petersburg at the Emperor Alexander I St. Petersburg State Transport University (PGUPS), which was recognized as the official event of the subgroup on transport and Logistics (see "BRICS Transport". Vol. 3. Issue 2. 2024). The conference was attended by representatives of higher educational institutions of the BRICS transport complex, as well as representatives of a number of transport companies from different countries. Reports and presentations were presented, in which topical issues of the development of various types of transport and the training of specialists for the transport complex were discussed The participants of the discussion were Oleg Valinsky, Rector of the Emperor Alexander I St. Petersburg State Transport University, Kirill Muzalevsky, Acting head of the subgroup on Transport and Logistics of the

[7] Speech by the President of the Russian Federation V.V. Putin. The BRICS summit meeting in an expanded format was held in Kazan. URL: https://e-cis.info/news/566/122154/

[8] Sergey Katyrin. *The BRICS Business Council continued to promote flagship initiatives*. URL: https://news.tpprf.ru/ru/news/6142806/

[9] BRICS expansion and integration in the field of transport. URL: https://1520international.com/en/content/2024/sentyabr-2024/brics-expansion-and-integration-in-the-field-of-transport/

[10] Order of the President of the Russian Federation dated 08.12.2021 No. 345-rp "On the appointment of representatives of the Russian Federation in the BRICS Business Council for 2022–2024". URL: http://publication.pravo.gov.ru/Document/View/0001202112080042?index=1

BRICS Business Council, Sergei Baryshnikov, Rector of the Admiral S.O. Makarov State University of Maritime and Inland Shipping, Valery Tanaev, Head of the Moscow Railway branch of Russian Railways, Minister of Transport of the Republic Cuba Eduardo Rodriguez Davila (via video link), Vice-President of Xi'an Jiaotong Transport University (PRC) Shan Zhiwei (via video link), Rector of the Far Eastern State Transport University Vladimir Burovtsev, Head of Marketing and Investment Department of Ethiopian Railways Gebremariam Moges Aregay, etc. The final recommendations of the conference were presented at one of the online meetings of the subgroup.

The result of the work of the subgroup was the creation of a section in the annual report of the working group on infrastructure and the subgroup on transport and logistics of the BRICS Business Council, which was discussed and approved on October 17, 2024 at a joint meeting held in Moscow in full-time and correspondence format, and submitted to the Business Council.

At the summit in Kazan, foreign participants shared their vision of the development of the transport industry within the framework of the BRICS[11]. Indian Prime Minister Narendra Modi noted: *"We talked about agriculture, supply chains, economic reforms, and all this should consolidate our economic cooperation. The initiative to create a research network also plays an important role in logistics and supply chains between BRICS member countries"*. He shared India's achievements in the field under consideration, in particular, the creation of the GatiShakti Portal digital platform. It allows to develop quickly multimodal connections, which makes it possible to create an integrated infrastructure, helps with planning and reduces logistics costs.

South African President Cyril Ramaphosa devoted a significant part of his speech to the transport sector: *"Like most countries in the world, the Republic of South Africa is making efforts to ensure the sustainability of supply chains, trade, tourism and financial flows that would not depend on external influence in a multipolar world. Working together, the BRICS family has an important role to play in addressing the key challenges of the Global South by building partnerships with emerging economies and markets. It is necessary to increase cooperation among the BRICS countries by launching common development programs in the field of exports, industrial cooperation and technology exchange. We call for the calibration and modification of trade routes to ensure more sustainable industrialization"*.

The President of the United Arab Emirates, Muhammad bin Zayed Al Nahyan, emphasized the serious progress of his country in a number of transport sectors, in particular logistics.

Dilma Rousseff, President of the New Development Bank, made a substantive report. For 2024–2025, the institution planned to provide financing for about 40 projects in the field of infrastructure, clean electricity, clean water, digital projects and transport worth more than ten billion dollars.

Chairman of the BRICS Interbank Cooperation Mechanism, as well as Chairman of the State Development Corporation VEB.RF Igor Shuvalov summed up one of the key areas of work of the Kazan Forum with the following phrase: *"The scale of the tasks we face to strengthen the independent financing system clearly indicates that we need to join forces to implement, first of all, cross-border projects in such areas as transport infrastructure and high-tech industry"*. It can be concluded that transport has again become one of the key areas of discussion in the context of unification for both the Russian Federation and its strategic partners this year.

Organizationally, over 30 countries of the world have expressed interest in cooperation with BRICS in one form or another, but the current members of the organization, as expected, decided to postpone further expansion. A list of BRICS partner countries was formed and in the final version included: Algeria, Belarus, Bolivia, Cuba, Indonesia, Kazakhstan, Malaysia, Nigeria, Thailand, Türkiye, Uganda, Uzbekistan and Vietnam[12].

Igor Kiselev, Ekaterina Sergeeva
Игорь Киселев, Екатерина Сергеева

[11] Expanded meeting of the BRICS summit. URL: http://kremlin.ru/events/president/transcripts/75375
[12] Main results of the 16th BRICS summit in Kazan, October 22–24, 2024. URL:https://spi-cis.ru/novosti/osnovnye-itogi-16-sammita-briks-v-kazani-22-24-oktyabrya-2024-goda

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Review article
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The railway transport development in the new BRICS countries

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ABSTRACT With effect from January 1, 2024, Egypt, Ethiopia, Iran, Saudi Arabia and the United Arab Emirates have become new members of the BRICS. Today, BRICS is an association of 10 countries that account for about 42 % of the world's total population (2.8 billion people) and 27 % of the global GDP.

According to experts, a major focus is made on the association's prospective economic potential and its expected share of the world's economy. What seems interesting in the context of the continued economic growth is the research in the field of development of the transport industry in the BRICS countries.

Earlier, the BRICS Transport journal (Issue No. 2 (4), 2023) presented an overview of the state and progress of high-speed railway transport in the five BRICS founding countries (Brazil, Russia, India, China, and the Republic of South Africa). In connection with the expansion of the transnational association, it is proposed that the research should be extended. The authors used both findings of scholarly works in the field of railway transport development, and BRICS summit reports and presentations available on Russian and foreign information platforms.

The paper analyses the development of railway transport in the countries that have joined BRICS recently (Egypt, Iran, the United Arab Emirates, Ethiopia, and Saudi Arabia), in particular, the prospects of development of express and high-speed rail services.

KEYWORDS: BRICS countries; Brazil; Russia; India; China; South Africa; Egypt; Iran; the United Arab Emirates; Ethiopia; railways; network; routes; length; speed; rolling stock; express and high-speed railways

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Обзорная статья

Развитие железнодорожного транспорта в новых странах БРИКС

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АННОТАЦИЯ С 1 января 2024 г. к межгосударственному объединению БРИКС присоединились новые страны: Египет, Эфиопия, Иран, Саудовская Аравия и Объединенные Арабские Эмираты. Сегодня организация насчитывает 10 стран, на долю которых приходится порядка 42 % населения планеты (2,8 млрд человек) и 27 % мирового ВВП.

По мнению экспертов, перспективы экономического потенциала объединения и прогноз его доли в мировой экономике — объект повышенного внимания. В условиях дальнейшего экономического роста интересными представляются исследования в области развития транспортной отрасли в странах БРИКС.

Ранее в журнале «Транспорт БРИКС», 2023, № 2 (4) был приведен обзор состояния и развития высокоскоростного железнодорожного транспорта в пяти странах-основателях БРИКС (Бразилии, России, Индии, Китае и Южно-Африканской Республике). В связи с расширением межгосударственного объединения предлагается дополнить исследования. Использованы результаты научных трудов в сфере развития железнодорожного транспорта, отчеты и доклады по итогам проведения саммитов БРИКС, опубликованных на российских и зарубежных информационных платформах.

Выполнен анализ развития железнодорожного транспорта в присоединившихся к БРИКС странах: Египте, Иране, Объединенных Арабских Эмиратах, Эфиопии, Саудовской Аравии, в том числе рассмотрены перспективы развития скоростного и высокоскоростного железнодорожного сообщения.

КЛЮЧЕВЫЕ СЛОВА: страны БРИКС; Бразилия; Россия; Индия; Китай; Южно-Африканская Республика; Египет; Иран; Объединенные Арабские Эмираты; Эфиопия; железные дороги; сеть; маршруты; протяженность; скорость; подвижной состав; скоростные и высокоскоростные железнодорожные магистрали

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INTRODUCTION

On August 2023, the 15th BRICS Summit took place in Johannesburg, South Africa. The heads of the member countries agreed to admit new members to the union[1] (*Fig. 1*).

The President of Russia Vladimir Putin put forward an initiative to create logistics and transport corridors between the member countries[3]. The key role, as noted by the President, is played by the development of railway transport as the most environmentally friendly, safe and reliable mode of transport. This demon-

Fig. 1. BRICS countries (after the 15th BRICS Summit, August 22–24, 2023, Johannesburg, South Africa)[2]

[1] The Russian National Committee on BRICS Research, Russia. URL: https://www.nkibrics.ru/pages/summit-docs
[2] BRICS. URL: https://infobrics.org
[3] BRICS geography grows in scale// 1520 International. URL: https://1520international.com/content/2023/sentyabr-2023/geografiya-briks-rastyet-v-masshtabakh-/

strates the relevance of the topic chosen by the authors and the need for further research on the development of the railway industry in the modern economic and political contexts.

MATERIALS AND METHODS

The authors have reviewed the findings of research by Russian scholars in the field of railway transport development and used reports and presentations published on foreign platforms, as well as web resources that cover the outcomes of BRICS summits.

FINDINGS

This paper presents an analysis of the development of railway services in the new BRICS member states: Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates.

Egypt

According to the International Union of Railways (UIC), as at the end of 2023, the total length of 1,435 mm railway track in use was 6,679 km, of which just a little more than 3,000 km had two or more tracks; the railways had no electrified sections [1, 2]. In recent years, the land of pyramids has led the region in terms of railway construction (*Fig. 2*), outrunning the United Arab Emirates (in the context of the new BRICS members in question).

According to the Global Data Report, in the 2010s, investment in railway projects amounted to USD 50 billion, with 45 % of that being accounted for by financing of projects under construction [3, 4].

In May 2022, the National Authority for Tunnels of Egypt signed a contract with Siemens Mobility, Orascom Construction and Arab Contractors to build three new high-speed railways with a total length of 1,985 km [3, 5]. The design of Siemens Mobility trains intended for Egypt is shown on *Fig. 3*.

The Suez Canal on Rails project is the first high-speed railway line to operate three main routes with trains running at a speed of up to 250 km/h. The 660 km network will connect cities between the Mediterranean and Red Seas extending to the border with the Republic of Sudan. Specifically, the high-speed line will con-

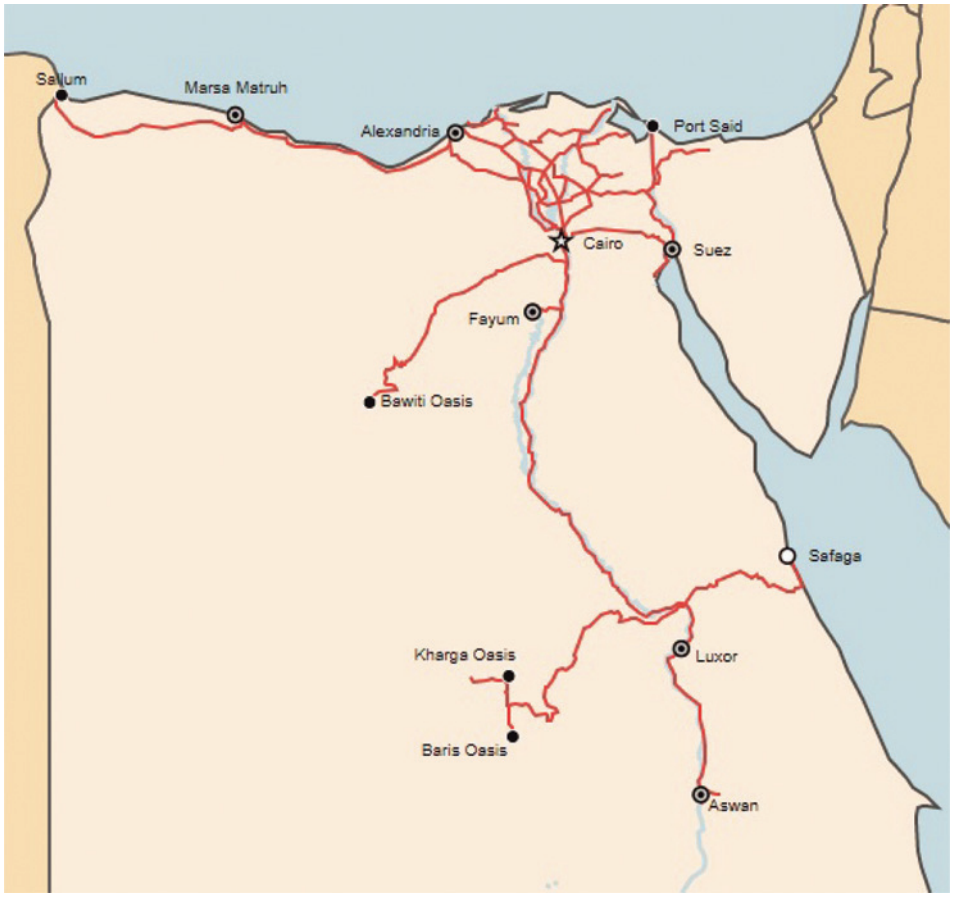

Fig. 2. Railway network in Egypt[4]

[4] Egyptian National Railways. URL: https://ru.abcdef.wiki/wiki/Egyptian_National_Railways

Fig. 3. Design of Siemens Mobility trains for Egypt [5]

nect Mersa Matruh on the Mediterranean coast with Ain Sokha on the Gulf of Suez of the Red Sea. It is expected that the future line will operate three types of trains: those running with few stops (express trains); traveling at an average speed of 230 km/h; regional passenger trains (up to 160 km/h); and goods trains (up to 120 km/h). The contract to build the Suez Canal on Rails will continue for 15 years (design, construction and maintenance of rolling stock). As predicted by experts, the first high-speed railway will carry about 30 million passengers per year and travel times will be reduced by two times [3].

The second high-speed line of 1,100 km will connect large cities and industrial centres along the Nile River in the south of Egypt [3]. The high-speed line will connect Cairo with Qena, Luxor, Aswan and Abu Simbel near the border with Sudan. The third high-speed railway of 225 km will connect Qena with the resort of Hurghada and the port of Safaga on the Red Sea.

The construction of the high-speed railway network in Egypt will require more than 40,000 new jobs [4]. It is expected that when all the three high-speed lines are commissioned, 90 % of the population in Egypt will be able to use the new, modern and safe mode of transport. The transition to railway transport with a fully electrified network will considerably reduce carbon dioxide emissions, contributing to overcoming the country's overall air pollution problem.

Ethiopia

The development of transport in African countries is a priority for economic growth. Ethiopia is one of the most rapidly growing economies in the region [6]. According to the International Union of Railways (UIC), as at the end of 2023, the total length of railway lines in use was 754 + 790 = 1,544 km, of which 146 km had two or more tracks, and 754 + 778 = 1,532 km of railways have been electrified [2].

In 2010, the Government of Ethiopia decided to create a new National Railway Network of Ethiopia (*Fig. 4*).

The Addis Ababa – Djibouti railway line in Ethiopia is owned by its Government via a state-owned company, Ethiopian Railway Corporation (ERC). Until 2023, the railway line was operated by Chinese companies, China Railway Group Ltd. and China Civil Engineering Construction Corp. From the beginning of 2024 onwards, the operation of the railway will be taken over by Ethio – Djibouti Standard Gauge Rail Transport S.C. The first new 392 km long line will connect Awash and Woldia. The second new 216 km long line will connect Woldia and Mekelle.

On September 21, 2023, the One Belt – One Way project marked its fifth anniversary. Africa's first electrified railway line connected the capitals of Ethiopia and

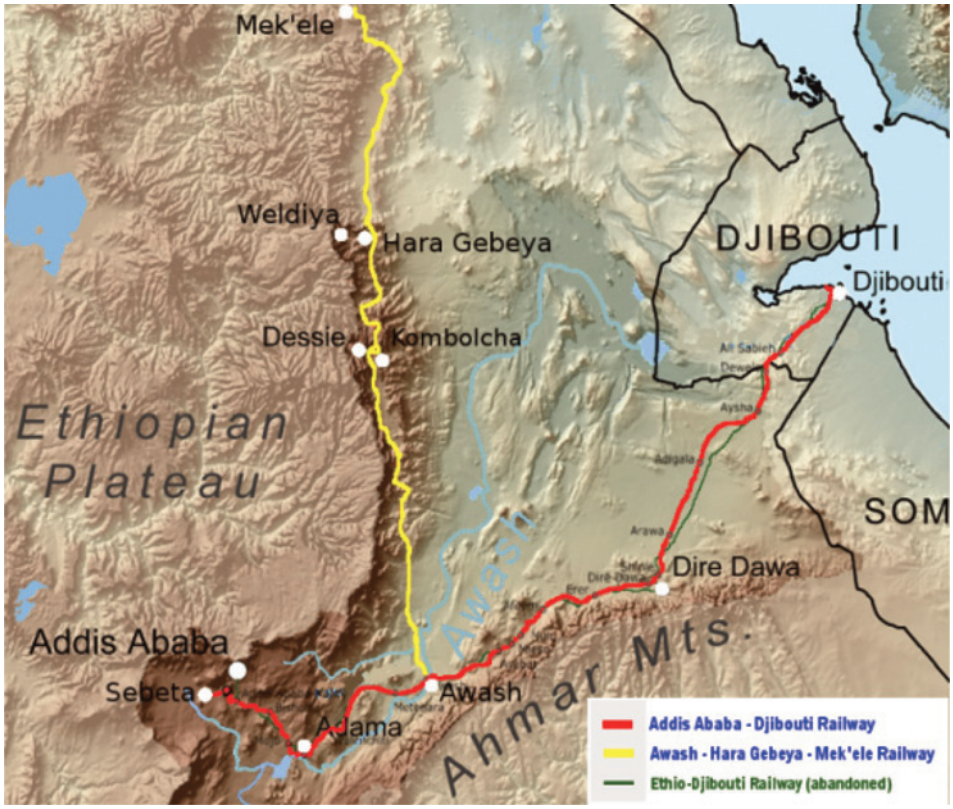

Fig. 4. Railway transport in Ethiopia[5]

Djibouti. More than 2,000 passenger trains and almost 8,000 goods trains have travelled on the line over the five years [7, 8].

Iran

The leadership of Iran places a significant emphasis on the development of railway transport as an essential component of the modern infrastructure with the view to strengthen their country financially and economically. During the sanctions period, Iran's transport projects were frozen. Railway transport was affected most of all (*Fig. 5*), as its modernization required much finance [9, 10].

According to the International Union of Railways (UIC), as at the end of 2023, the total length of railways in use was 9,556 km, of which 181 km were electrified lines [2].

On May 17, 2023, President of Russia Vladimir Putin and Iranian President Ebrahim Raisi signed an agreement to build a 162 km railway line between Rasht and Astara in Iran [11].

Vladimir Putin noted that the line to be built will contribute to establishing railway services across the North – South route with an access to the water way to India. On this section, goods are currently carried by road and need to be trans-shipped twice between modes of transport. Thanks to this, delivering goods from St. Petersburg to Mumbai will take 10 days rather than 1–1.5 months on other routes. The project has been pending for a long time. In 2011, Russian Railway JSC, Iranian Railways and Azerbaijani Railways CJSC signed a Memorandum of Understanding. The companies have agreed to cooperate in the implementation of a project to build the Rasht (Iran) – Astara (Iran) – Astara (Azerbaijan) railway line.

The construction of the Rasht–Astara line is planned to be completed by 2028, as was announced by the head of the Russian Ministry of Transport Vitaly Saveliev at the government hour in the State Duma [11]. It is expected that the Rasht – Astara line will be built by Russia and Iran and the construction of the Astara (Iran) – Astara (Azerbaijan) line will be contributed to by Russia, Iran and Azerbaijan. The North – South transport corridor will significantly change logistics and the economy on the continent (*Fig. 6*).

In 2018, Russian Railways Holding started work to electrify the Garmsar – Inche Burun line in Iran. According to experts, electrification of the line will have substantial economic effects. The two-fold growth of speed will lead to increasing the carrying capacity

[5] Transport in Ethiopia. URL: https://mungfali.com/post/55D47619C7D067054BAE7CDC93741EB35B53AD32/

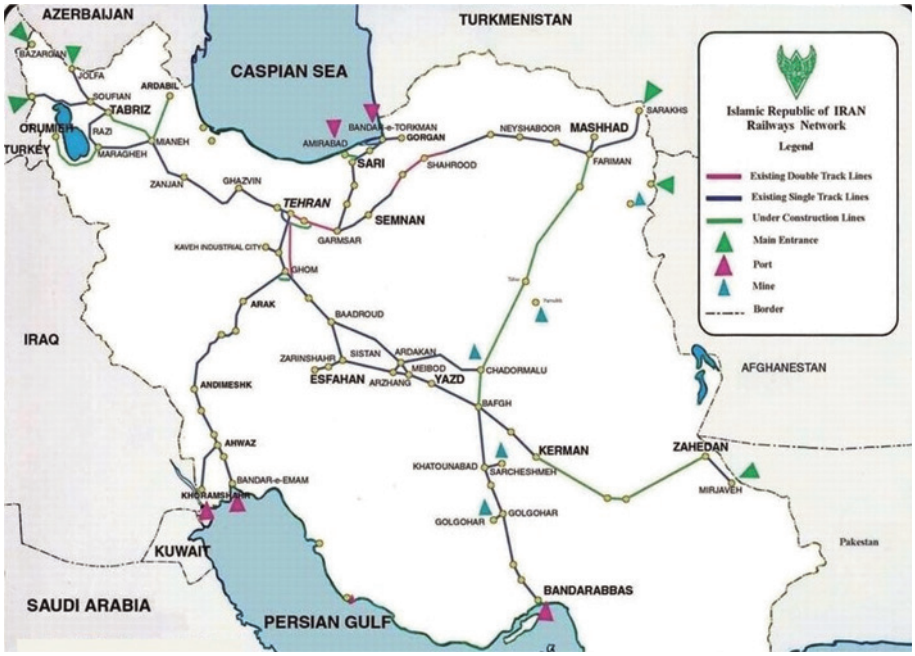

Fig. 5. Railway network in Iran[6]

Fig. 6. North – South international transport corridor[7]

four times to up to 10 million tons per year. An effect regarded particularly positive is lower air emissions, which will help improve the environmental status of the areas adjacent to the line. As highlighted at the ceremony in Teheran, the project will last four years and four months and will provide the electrification of a 495 km long line. The contractor is RZD International LLC (a subsidiary of RZD JSC).

During a conference on October 3, 2023, the Managing Director of Railways of the Islamic Republic of Iran (RAI) [12, 13] said that the railway is essential for the development of the transport sector which is vital

[6] Russia and Iran: A new dimension of a strategic partnership // Cezarium. URL: https://cezarium.com/intervyu-s-igorem-morozovym/
[7] The North – South International Transport Corridor — the Indian Ocean: Complementary routes are in demand. URL: https://dzen.ru/a/ZNCrT77DPzySEbmG

for the economic growth of the country. He also announced that passenger rail traffic had hit its record high in the 1401 Iranian calendar year and added that in the previous year the national railways had carried 29.67 million passengers, which also suggests growth of 43 % on a year-to-year basis. 346 new wagons were added to the railway fleet, including 339 freight wagons, 5 passenger coaches, and 2 locomotives. The wagons were manufactured by Iranian companies Mapna Group, Pars Wagon, Kowsar Wagon Complex, and Green Polour Industrial Group.

Saudi Arabia

The need for the development of railways in Saudi Arabia is driven by a large population, which generates demand for logistics and more extensive use of the country's territory.

According to the International Union of Railways (UIC), as at the end of 2023, the total length of railways in use was 4,309 km, of which 2,883 km had two or more tracks, and 3,390 km of railways have been electrified [2].

The country's railways are run by two state-owned companies: the Saudi Railways Organization and the Saudi Railway Company.

The Haramain high-speed railway between Mecca and Medina is 450 km long (*Fig. 7*). With high-speed trains, the travel time between Mecca and Jeddah has become two times shorter. The speed of the Talgo T350 train running on the line reaches 310 km/h. According to the contract, 35 trains, with each capable of carrying more than 400 passengers, were supplied by Talgo to the Saudi Railways Organization.

Currently, the country's largest project is a section of the North – South corridor (the NSR project). The project provides a network of 2,400 km for freight and passenger traffic. The maximum running speed on the line will be 250 km/h for passenger trains and 120 km/h for goods trains. The larger part of the network is located in a desert with high temperatures and air dryness. Solar radiation has a strong effect on track components. Therefore, electronic components of track transponders in the automatic train traffic control system are protected by additional sun shields that do not affect the functionality of the devices [14]. The railway network will be equipped with a European control system and a radio network. CEOs of RZD JSC and the Saudi Railway Company signed an agreement to implement the Saudi Vision 2030 programme for the development of the railway network. It involves the renovation and retrofitting of the existing railway infrastructure and construction of 2,000 km of new lines and more than 20 passenger stations.

Fig. 7. Railway network in Saudi Arabia[8]

[8] URL: https://upload.wikimedia.org/wikipedia/commons/a/a7/Rail_transport_map_of_Saudi_Arabia.pn

The United Arab Emirates

The first railways appeared here as early as the 19th century, but there was no development in this area until the middle of the last century [15]. According to the International Union of Railways (UIC), as at the end of 2023, the length of railways in use was 279 km, of which 119 km had two or more tracks. The line has not been electrified [2]. In 2023, Etihad Rail basically completed the creation of the UAE national railway network (*Fig. 8*) which is 1,200 km long.

The national railway network in the UAE (*Fig. 9*) is compliant with the global Sustainable Development Goals and the UAE Net Zero by 2050 strategic initia-

Fig. 8. Map of the UAE national railway network[9]

Fig. 9. A goods train on a railway section in the desert of the UAE[10]

[9] Etihad Rail is the first railway in the UAE // Railways of the World. URL: http://1430mm.ru/etihad-rail-pervaya-zheleznaya-doroga-oae
[10] URL: http://1430mm.ru/etihad-rail-pervaya-zheleznaya-doroga-oae

Fig. 10. Palm – Jumeirah Monorail, UAE[11]

tive[12] [16, 17]. By 2050, it is planned to reduce carbon emissions and road transport emissions by 21 % and 40 %, respectively.

In 2009, a 5.5 km long Palm – Jumeirah monorail system was built by Hitachi using the ALWEG straddle-beam technology. The line is capable of carrying up to 40,000 passengers at a speed of up to 70 km/h (*Fig. 10*).

CONCLUSION

Based on our analysis, it should be noted that the new BRICS members are both building new ordinary railway lines and developing routes for express and high-speed railway systems.

In Egypt, the length of railways is about 10,500 km, with 5,500 km of lines being under construction. It is planned to build about 900 km of high-speed lines for trains running at 320 km/h and 660 km of high-speed lines with train speeds of up to 250 km/h. In Iran, the length of railways is about 15,040 km, and 3,726 km of railway lines are being built or designed. It is planned to commission more than 1,400 km of new express (200 km/h) and high-speed lines. In the UAE, the total length of the railway network is 1,200 km; 150 km of lines are being designed, and about 900 km of lines are under construction. In Ethiopia, the length of the railway network is 750 km.

Railway transport is very important for the development of the economy of any country, creating a competitive environment in the transport industry, providing reliable and secure transport connections both on the passenger and freight segments of the transport market, and contributing to the creation of new jobs. High-speed lines are, in turn, the drivers of the progress, offering passengers a new, modern and comfortable mode of transport [18–20]. The implementation of high-speed railway projects provides an environment for continuous growth of the country's science and technology potential and, most importantly, for solving the global environmental problem of pollution.

Based on the study of the new transport and logistics corridors and increased train speeds in various countries, we find it reasonable to continue monitoring the development of the railway industry in the BRICS countries, especially in the context of the current economic and political landscapes.

[11] URL: https://happylove.top/52848-dubaj-palma-monorels.html

[12] Net Zero is a term frequently used in the environmental industry. The purpose of Net Zero to combat climate change by reducing emissions and balancing them with carbon sinks, such as woods, oceans and other various environmental resources that absorb carbon dioxide from the atmosphere. URL: https://www.iea.org/reports/net-zero-by-2050

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The development of passenger carriage design and passenger service on the railways of India: The end of the 19th – the first half of the 20th century

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ABSTRACT By the end of the nineteenth century, several dozen railway companies operated in India on intercity routes, including those of several thousand kilometres in length. On both wide and narrow gauge lines, various wagons were operated: from Classes IV and III with almost no amenities (often even without the simplest benches for sitting) and up to luxury Class I coaches and saloon coaches. Almost until the beginning of the twentieth century, when organizing passenger transportation, railway companies focused on a relatively small circle of European colonizers — civil servants, British military and wealthy entrepreneurs, including Indians, and, to a lesser extent, on middle–income Indians, while virtually ignoring the interests of the poorest population groups, which made up the vast majority of Indian society. Based on the above, a fleet of passenger carriages of wide, metre and narrow gauge lines was also formed, while, of course, all technical innovations and improvements related to improving travel comfort were initially introduced in saloon coaches, first-class carriages and, decades later, often in second-class, and then third- and fourth-class carriages. This situation remained almost until India gained independence in 1947. Real improvement began in the 1960s with the renewal of the country's passenger coach fleet and an increase in the overall level of passenger service, including the second and third classes.

KEYWORDS: history of Indian railways; development of passenger transportation; types of passenger rolling stock; classes of passenger transportation

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Обзорная статья

Развитие конструкций пассажирских вагонов и обслуживание пассажиров на железных дорогах Индии: конец XIX – первая половина XX столетия

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АННОТАЦИЯ К концу XIX столетия в Индии действовало несколько десятков железнодорожных компаний, осуществлявших междугородные маршруты, в том числе протяженностью в несколько тысяч километров. На дорогах широкой и узкой колеи эксплуатировались вагоны различного класса: от IV и III — практически без удобств (часто даже без скамеек для сидения) и до роскошных вагонов I класса и вагонов-салонов.

До начала XX в. железнодорожные компании при организации пассажирских перевозок ориентировались на относительно небольшой круг европейцев-колонизаторов, государственных служащих, британских военных и богатых предпринимателей, включая индийцев, меньше — на индийцев среднего достатка, и игнорировали интересы беднейшего населения, составлявшего его подавляющую часть.

Исходя из вышеизложенного формировался и парк пассажирских вагонов широкой, метровой и узкой колеи, при этом все технические новинки, улучшения, касающиеся повышения комфорта проезда, первоначально внедрялись в вагонах-салонах, вагонах первого класса и часто спустя десятилетия в вагонах второго, а затем третьего и четвертого класса.

Такое положение сохранилось практически до обретения Индией независимости в 1947 г., реальные сдвиги к лучшему происходят с 1960-х гг. с началом обновления пассажирского вагонного парка страны и повышения общего уровня обслуживания пассажиров, включая второй и третий класс.

КЛЮЧЕВЫЕ СЛОВА: история индийских железных дорог; развитие пассажирских перевозок; типы пассажирского подвижного состава; классы пассажирских перевозок

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According to Indian researchers, the construction of railways in the 19th century brought no real benefits to the majority of the many millions of inhabitants in the country. *"Railroads were introduced to India for quicker and more efficient access to trade. Unfortunately, they had the unintended consequence of exacerbating both environmental and economic conditions that proved damaging in times of famine. The goals of the plan to introduce railways were to lower transport costs and to give English merchants easier access to raw cotton from India. Also, the railway would simultaneously open the Indian market to British manufactured products such as cotton textiles. Initially, neither the railways promoter nor the East India Company envisioned much of a demand for passenger traffic"* [1].

For the first two or three decades of the railway's existence in India, passenger transportation was virtually unaffordable for most Indians [2]. By the 1870s, however, passenger traffic began to gradually increase.

By the last quarter of the 19th century, passenger transportation on the Indian railways had several classes of service and, accordingly, several types of carriages, varying considerably in comfort level. Small railway companies (firstly, those having railway lines with the one metre gauge, or metre gauge, MG, and those with the narrow gauge, NG), were divided into two classes: the so-called "upper class" and "lower class" (e.g., "Bengal" and "Northwestern" Rly. (MG) and the "Barsi Light" Rly. (NG) [3].

In general, by that time, four classes of service had formed on the railways of different gauges[1] in India, based on the differences in socio-economic categories of the population — between the richest and the poorest (the gulf separating them was huge). Accordingly, four types of carriages were used, with different technical equipment and arrangement of passenger compartments: ranging from coaches of the fourth class to the first class, and higher to saloon carriages, of which there were literally only a few. The passenger service system, based on class division, was largely the same as that which existed on the metropolitan railways.

LUXURY OF SALOON CARRIAGES

The gulf that separates the fourth- and third-class passengers from privileged travellers is much in evidence when comparing their accommodation with that of first-class coaches, and even more so with luxury saloons. However, studying the history of construction and operation of the latter is important for understanding the process of technical development of rail coach manufacturing. At first, technical innovations were introduced in the designs of saloon and first-class carriages, and then in others.

By today's standards, the first saloon carriages, often presented in historical literature as 'palaces on wheels', were small, two-axle railway carriages with wooden frames and bodies, only about 10 metres long, and with luxurious interiors.

Naturally, Indian saloon carriages were built after the model of railway carriages designed for the British

[1] At the time of independence in 1947, India had a railway network with a total operational length of 54,500 km. Of these, 25.8 thousand km (47 %) were wide-gauge (1,667 mm) lines; 24.6 thousand km (44 %) were metre-gauge lines, and about 5.3 thousand km (9 %) had the narrow gauge (762 mm and 610 mm gauge lines) [4].

Fig. 1. The oldest surviving British royal carriage is an authentic Queen Adelaide's saloon carriage, National Railway Museum, York, England. Photo by the authors. 2013

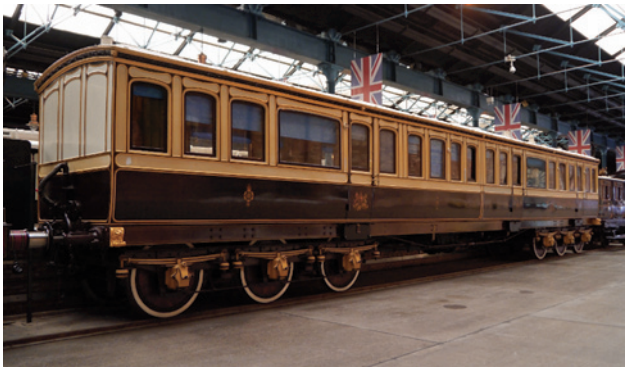

Fig. 2. Queen Victoria's saloon carriage, built by Wolverton Works in 1869. National Railway Museum, York, England. Photo by the authors. 2013

royalty. In England, the first such saloon carriage was built in 1842 for Queen Adelaide. The carriage is reposited at the National Railway Museum in York (*Fig. 1*).

The carriage was built in 1842, and its appearance clearly shows its origins as a horse-drawn carriage. The car body resembles three carriages mounted in a row on a common frame. National Railway Museum, York, England. Photo by the authors. 2013.

British royal carriages had an elegant but rather modest appearance and luxuriously finished interiors in a style that would later be called Victorian[2]. As an example, let's take two saloon carriages built a quarter of a century apart: Queen Adelaide's saloon carriage (1842) and Queen Victoria's saloon carriage (1869) (*Fig. 2*, *3*). The frames and bodies of the carriages were made of wood; rare woods were used in the finishing, varnished or painted.

It is interesting to compare the appearance of the British royal carriages with one of the saloon carriages of the same period, built for King George V by the Hanover Railway in 1853. The carriage resembled a genuine coronation carriage (*Fig. 4*).

Even more curious is a unique vehicle in this category, — a steam locomotive (or more accurately, a steam locomotive carriage) which was built for the Viceroy of Egypt Said Pasha by the British company Robert Stephenson in 1862 (item No. 1295/1862). A small saloon, or rather a passenger compartment, luxuriously upholstered inside with brocade and silk,

Fig. 3. The interior of Queen Victoria' saloon carriage, built by Wolverton Works in 1869. National Railway Museum, York, England. This is the furnished interior of Queen Victoria's saloon carriage / Valeiko Karlina These historic photos reveal how rail travel used to look[3]

Fig. 4. Railway carriage of George V of Hanover, 1863[4]

[2] The Victorian style originated in early 19th century England and combined the most contrasting exotic and new historical design trends. Despite the pretentiousness of Victorian-style rooms, they remained cosy. This combination was achieved thanks to certain rules of design and the use of decorative elements.
[3] URL: https://uk.style.yahoo.com/historic-photos-reveal-rail-travel-130000939.html
[4] URL: https://picryl.com/media/eisenbahnsalonwagen-von-georg-v-1853-9c903d

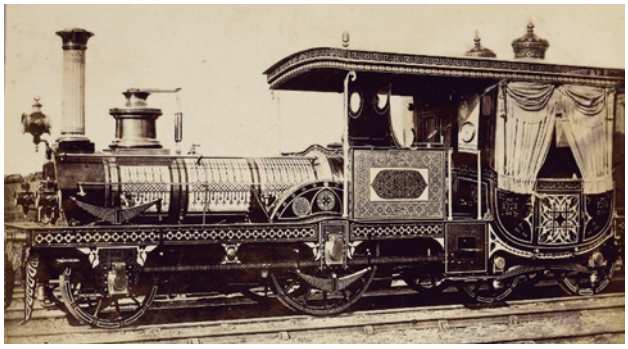

Fig. 5. Egypt Railways — The Egyptian Viceroy's private 2-2-4T steam locomotive (Robert Stephenson Locomotive Works 1295/1862) [5]

Fig. 6. Prince of Wales Saloon: built at Agra Workshop pg RMR in 1875 for Prince of Wales (later King Edward VII) for his visit to India for Royal Darbar in 1876[5]

was placed on the frame of the 1-1-2 T tank engine together with the driver's cabin.

The design of the locomotive carriage was developed by the famous English decorator Matthew Digby Wyatt, a *specialist in Arabic design* (*Fig. 5*). The carriage was decorated in white and black colours with gold trim. The passenger compartment was separated from the driver's cabin by a door and Said Pasha often stepped out and drove himself, moving the handles made of silver [5].

In India, the first saloon carriage was built in 1863 (or, according to other sources, in 1864 or 1866) for the Governor of Bombay[6] [6]. The National Railway Museum in New Delhi exhibits the surviving saloon coach of Prince of Wales, the future King Edward VII (*Figs. 6*, *7*). It was built in 1875 by Agra Workshop pg RMR for a journey across India in 1875[7] [7]. Saloon carriages were used by rulers of separate provinces or territories, major officials of colonial and local administrations (*Figs. 8–11*).

Fig. 7. The interior of the Prince of Wales Saloon with the wax figures installed by the museum. Restored by Pratapnagar and Lower Parel Workshop. Complete restoration including electrical equipment, furniture. (Subhabrata). The IRFCA Photo Gallery [8]

Fig. 8. Broad-gauge coach of Maharaja of Baroda Sayajirao Gaekwad III. Restored by Pratapnagar and Lower Parel Workshop. Complete restoration including electrical equipment, furniture. (Subhabrata) [9]

Fig. 9. RA-6 saloon carriage built in the early twentieth century. Restored by Pratapnagar and Lower Parel Workshop. Complete restoration including electrical equipment, furniture. (Subhabrata). The IRFCA Photo Gallery. 2015 [8]

[5] URL: http://trainweb.org/railworld/NRM/national_railway_museum7.htm
[6] We could not find any images of this saloon carriage.
[7] In 1875, the Prince of Wales made an eight-month tour of India on what became known as the Royal Durbar.

Fig. 10. Interior of RA-6 saloon carriage. The IRFCA Photo Gallery. 2015 [8]

Fig. 11. The interior of Baroda Maharajah's coach of 1925, Delhi Railway Museum, February 2016 [8]

FOUR CLASSES OF COACHES OF INDIAN RAILWAYS

The four classes of coaches on regular trains included comfortable first-class carriages with isolated compartments. According to some sources, in the 1860s, such coaches had already been equipped with individual toilets[8], and some with shower rooms (cabins) [6]. The compartments of these coaches were furnished with costly furniture: upholstered armchairs, sofas, beds, carved tables and chairs (*Fig. 12*). First-class coaches usually had a small cabin with a shelf (or berth) for two or three servants, adjacent to a spacious compartment. Second-class coaches also had isolated compartments, but smaller in size, without toilets and with simple furniture.

In the first decades of the 20th century, first-class coaches without corridors[9] were still the most attractive way for British colonialists and wealthy Indians to travel. Following is the description of such a coach given in an article by researcher Dipak Raychaudhuri: "Indian Railways in Old Days During the British Raj[10]. Part-II": *"The compartment ran the full width of the car, thereby making it super-luxurious in terms of Space. Entire coach was divided into 6 individual cabins or suites (one 6-berth cabin, two 2-berth cabin, and three 4-berth cabin). Each cabin was a separate room or suite with its own doors opening on either side of the carriage right*

Fig. 12. A variant of a compartment in a first-class coach of the Indian Railways. The late 19th century [2]

[8] According to some sources, private toilet facilities in first-class compartments did not appear until the early 1880s, and according to others, not until 1891 [10].
[9] The features of the coach arrangement with and without corridors are considered in detail in the paper of Vladislav B. Zakharov, Egor Komarov. Volume Passenger Rolling Stock of Indian Railways in the First Half-Century of their Operation. 2024, Volume 3 Issue 1.
[10] The British Raj (from Hindi rāj, "kingdom", "realm", "state", or "empire") was the rule of the British Crown on the Indian subcontinent, it is also called Crown rule in India, or Direct rule in India, and lasted from 1858 to 1947.

onto the platform and each of these cabins had a plush toilet facilities in the Western style and an attached shower room, as well as a narrow compartment at one end with a bench and sometimes a single berth above, for the travelers' domestic servants. The interior of these coaches was ultra-luxurious including royal-size beds/berths, carpeting, wood-work, all paneling and good electric lighting with each berth also having individual reading lights, and a minimum of two electric ceiling fans".

In third-class coaches, there were wooden benches in common passenger rooms. The lowest level of comfort was in fourth-class coaches, which were actually freight wagons. They had wooden bodies on wooden frames (four walls and a roof), with no seats, benches or berths, and looked very much like cattle wagons. Passengers sat or lay on the floor. Third- and fourth-class coaches had no lighting and no ventilation other than natural ventilation through open unglazed windows and outside doors (*Fig. 13*) [2].

From the 1860s (or, according to other sources, from the 1880s or even from 1891), toilets were only provided in first-class coaches, while all second- and third-class travellers had to obey the call of nature when trains stopped in the vicinity of stations. In addition to physiological and hygienic problems, the lack of water also caused mental suffering for Muslim passengers...

The decision to set up toilets in all second- and third-class coaches on Indian trains running more than 50 miles (80 km) was taken by the Railway Board as late as in 1905 [11], but even after several years it was not implemented.

On July 2, 1909, an unpleasant incident happened to a passenger by the name of Okhil Chandra Sen travelling in a second-class coach on the West Bengal Railway. He went to the station facilities, failed to get back on the train in time, and while trying to catch the departing coach, he fell and was injured... The victim wrote a letter to the Sahibganj Divisional Office, angrily describing the incident and demanding that the decision to install toilets in coaches be implemented. The letter made the newspapers and caused a stir[11]. According to some historians, this very event and the scandal erupted prompted the railway authorities to begin installing toilets in second- and third-class coaches.

Fourth-class coaches as described here began to be withdrawn out of the traffic by the 1870s[12], being replaced by third-class coaches. By the early 1880s, only

Fig. 13. Third-class coaches of the Indian Railways. The turn of the 19th and 20th centuries [2]

a few Indian railways had fourth-class coaches, and by 1885, the fourth class of travel on Indian railways was completely abolished. Wooden benches were installed in former fourth-class coaches and these carriages were reclassified as third-class.

In the 1860s, passenger traffic on Indian railways increased. The initial abolition of fourth-class coaches led to a shortage of seats in third class. From 1862, in order to increase the capacity of these coaches, upper berths were added to the benches (lower berths) placed on the floor. Passengers could sit on them when the coach was crowded. Initially, when the coach was not crowded, passengers were allowed to lie on the upper berths, whereas only to seat on the lower benches (berths) [6].

Almost until the beginning of the twentieth century, first- and second-class coaches on Indian railways were used exclusively by Europeans and a few very rich Indians, and this segregation was based on economic reasons: very high ticket prices. Almost the entire native population of the country was only allowed, with great difficulty, to travel by the third class.

By the beginning of the 20th century, the design of comfortable saloon carriages — palaces on wheels with exquisite furniture, carpets, individual toilets and sometimes shower cabins, as well as first-class carriages in India, had incorporated the latest achievements of rail coach manufacturing and provided a high level of travelling comfort to a small circle of privileged passengers.

In the 1880s, long-distance trains had dining carriages (*Fig. 14*) with kitchens equipped with gas cook-

[11] This letter survived in the Railway Museum in Delhi and became part of the history of Indian Railways as one of the documents of the passenger's victory in the struggle for his rights. The Hilarious Letter of Okhil Chandra Sen that Prompted Indian Railways to Install Toilets on Trains [12].

[12] Different sources contain contradictory information about the time of the introduction and abolition of fourth-class coaches. Thus, paper [10] notes that in 1874–1880, "Despite early fears that the railways would be little used, passenger traffic is now so heavy that fourth class is introduced on some lines, to deal with overcrowding. This is achieved by removing all or most of the seating from third class carriages and redesignating them — 'a palliative which was short-lived'."

Fig. 14. Inside a Great Indian Peninsula Railway dining carriage, probably first class. The food served in the dining carriages was British rather than Indian. (Image: Getty Images) [13]

Fig. 15. The wooden Vice Regal Dining Car, painted with white enamel, was built in the Ajmer workshops of BB & CIR (Bombay, Baroda & Central India Railway) in 1889. The carriage was used by the Viceroy of India during his travels around the country and was part of a five-car Vice Regal train. The National Railway Museum, New Delhi [4]

ers and iceboxes[13]. Next to the dining carriage, the train often had a service carriage with a storeroom and places for the service personnel of the dining carriage, and a room for guards.

At that time long-distance trains had dining carriages, but some shorter journeys did not have dining facilities. Trains stopped at certain stations for passengers to visit refreshment rooms. The food served in the dining carriages was British rather than Indian, as the British were in control of India at that time (Image: Getty Images)

Luxury dining carriages were also included in special trains of high-ranking officials. Such trains usually consisted of a saloon coach, two or three first-class coaches for attendants, and a dining car. Such, for example, was the train of the Viceroy of India, Vice Regal, in the late 1880s (*Fig. 15*) [14].

PASSENGER ROLLING STOCK OF METRE AND NARROW GAUGE RAILWAYS

You will recall that in the late 1940s, the total operational length of the Indian railway network was 54,500 km: 24,600 km (44 %) were metre gauge and about 5,300 km (9 %) were narrow gauge (762 mm and 610 mm) lines [4]. The entire length of these lines was used for both freight and passenger traffic, and this required appropriate rolling stock. On metre and narrow gauge railways, comfort levels were divided into two classes: upper and lower class.

Naturally, it was more difficult to achieve a level of comfort in metre gauge coaches, especially in 762 mm or 610 mm gauge coaches, comparable to that provided in broad gauge coaches. Nevertheless, attempts were made to provide higher levels of travelling comfort for colonial officials, British military servants and businessmen who were forced by fate to travel far from the main roads. The challenges of 'lower class' transportation were beyond the attention of railway companies. Several examples of metre and narrow gauge coaches of different classes have been preserved in Indian museums (*Fig. 16–18*).

Fig. 16. Coaches (left to right) of the third, first and third classes of the narrow gauge Matheran Light Railway or the Matheran Hill Railway (MHR) with the 620 mm gauge track, 21 km long in the Western Ghats[14]. The line was opened in 1907 and thereafter its operation was suspended several times due to damage caused by natural disasters; however, it has been back to regular operation since November 2012. Matheran Light Railway coaches, Delhi Railway Museum, February 2016 [8]

[13] Iceboxes were replenished with blocks of ice at major stations. Please refer to Vladislav B. Zakharov, Egor Komarov. Passenger Rolling Stock of Indian Railways in the First Half-Century of Their Operation / BRICS Transport. Scientific and Practical Peer-Reviewed Journal. 2024. Vol. 3 Iss. 1.

[14] The Western Ghats, or Sahyadri, is a mountain range in Western Hindustan. It stretches north-south along the western edge of the Deccan Plateau, separating this plateau from the narrow coastal plain along the Arabian Sea.

Fig. 17. Third-class coach of the open type (without windows) with separate compartments and individual exterior doors built in the early twentieth century by the Nilgiri Mountain Railway[15] [8]

Fig. 18. Interior of the passenger compartment of a first-class coach on the Satpura Railway narrow gauge (762 mm) line. It was built in 1904 in Madhya Pradesh and Maharshtra in central India, and was 419 kilometres long. The coach was in use until 2015 when it was withdrawn from service due to the railway's conversion to 1,676 mm wide gauge in 2018 [2]

At the beginning of the 20th century, combustion engines were introduced on the world's railways. Initially fitted on small handcars, they were later installed on railcars designed for 10 to 20 passengers. Mainline diesel locomotives appeared in the 1930s [15]. Railcars with petrol and diesel engines — small train vehicle units, which replaced the locomotive carriages[16] — were used on low-traffic lines (*Fig. 19–21*). Rail-mounted cars and buses were often used on narrow gauge railways [16].

Fig. 19. A twelve-seat railcar of the (762 mm) narrow gauge Kalka-Shimla[17] railway, built in 1931 by Wickham, UR [16]

Fig. 20. Railcar RMC 14 of the (762 mm) narrow gauge Kalka-Shimla Railway[17] built in 1933 at Armstrong Whitworth, UR [167]

Fig. 21. Interior of Railcar RMC 14 of the Kalka-Shimla Railway [8]

[15] The metre gauge Nilgiri Mountain Railway (NMR) is 46 km long and was built in Tamil Nadu district in 1908. Currently, it is managed by the Ministry of Railways of India and used for commercial operation.
[16] Lightweight two- or four-axle narrow and wide gauge coaches equipped with small steam engines and compact, mostly direct-flow steam boilers, which were usually heated with liquid fuel — oil, fuel oil, or paraffin. Service vehicles were also used for passenger services on low-traffic lines until the beginning of mass distribution of internal combustion-engine railcars.
[17] The (762 mm) narrow gauge Kalka-Shimla railway of 96.6 km in length in North India. It was opened in 1903. Currently it is managed by the Ministry of Railways and is included in the list of World Cultural Heritage Sites. It is considered that its route passes through some of the most picturesque places in the country. It is operated as a cultural and tourist attraction.

DEVELOPMENT OF PASSENGER COACH DESIGNS FOR INDIAN RAILWAYS AT THE TURN OF THE 19TH AND 20TH CENTURIES

The technical equipment of the passenger coach fleet of the Indian railways has been improving at about the same rate as in the railways of other countries, usually with some (3–5 years) lagging behind the metropole and other advanced countries.

Initially, all passenger coaches were two-axle and by the end of the 19th century they became three-axle. Then bogie carriages began to be introduced; these were usually two-axle, which made the running smoother and improved the comfort of travel.

Until the 1870s, coaches on Indian railways — as it was initially on railways in all countries — had wooden frames and wooden bodies. Even at travel speeds of about 40–50 km/h, wooden coaches would literally smash to pieces when coming into collision or derailing (*Fig. 22*).

You will recall that in the public consciousness of that time, regular rail accidents were perceived as an inevitable phenomenon. Such a situation was even in Great Britain, a country with the most advanced railway technology and equipment at the time.

In 1885, the first steel-framed coaches, still with wooden bodies, were introduced in Indian railways [18]. Carriages with bodies that had the so-called metal 'half-walls' reaching up to the level of windows appeared at the turn of the century. In 1902, the country started to produce all-metal passenger carriages. A year later, in 1903, bogie carriages were put into operation [11]. The construction of coaches with steel frames and wooden bodies, and later with all-metal bodies (the so-called all-steel coaches), was an important factor in improving transport safety.

In the first decades of the twentieth century, Indian railways began to purchase passenger coaches with vestibule platforms between carriages [a vestibuled train] (*Fig. 23*), which allowed for safe and comfortable movement of passengers and service personnel from one coach to another[20]. On June 1, 1930, the Deccan Queen[21] high-speed passenger train was put into operation on the route between Bombay (Mumbai) and Pune1 (Poona). All of its coaches had enclosed vestibule platforms, allowing passengers to move freely around the train and visit the dining carriage.

From 1879, the coaches of Indian passenger trains were equipped with vacuum automatic continuous brakes[22], which improved safety and increased the speed of travelling [18].

Fig. 22. The Accident Near Nagpur on the Great Indian Peninsula Railway. 5 November 1891 — A mail train derailed near Nagpur, killing 10 passengers and injuring 34 others[18] [17]

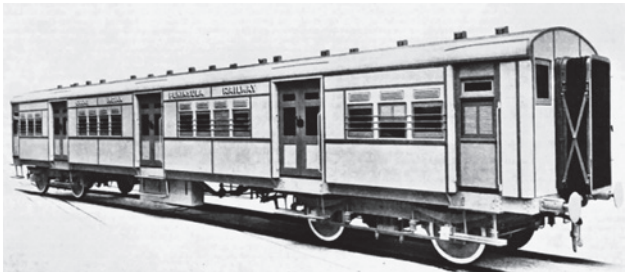

Fig. 23. All-metal third-class coach with two-axle bogies built in the 1910s and 1920s by Cammell-Laird & Company, Nottingham, UK, which during this period, in addition to its core business, shipbuilding, was also involved in building carriages for railways and metropolitan railways. The photo shows one of India's first railway coaches with an enclosed vestibule platform[19]

[18] Accident Near Nagpur on the Great Indian Peninsula Railway: The Wreck of the Leading Engine is Shown Lying Upon Its Side. URL: https://www.magnoliabox.com/products/the-accident-near-nagpur-on-the-great-indian-peninsula-railway-the-wreck-of-the-leading-engine-lc130411-0392-2

[19] India Railways – Great Indian Peninsula Railway – Third Class all-steel passenger coach (Cammell-Laird & Company, Nottingham, UK). URL: https://www.flickr.com/photos/124446949@N06/24263421452

[20] Previously, passenger coaches in India had open intercar walkways, which were uncomfortable and unsafe when passengers had to walk from one coach to another. When the American Pullman Company introduced enclosed vestibule platforms between coaches in 1887, it was the first time that the coaches of a passenger train were united into a single comfortable space, and it was the beginning of the creation of Pullman luxury trains, known as 'palaces on wheels'.

[21] The name of the train comes from a popular nickname for Pune "दख्खन ची राणी" (Queen of the Deccan), the cultural capital of the region. The city is located in the historical and socio-political region known as the Deccan, in the mountainous plateau of the same name that stretches to the south of Mumbai from the coast of the Arabian Sea to the Bay of Bengal.

[22] In the vacuum brake system, braking force was produced by atmospheric air pressure, and the brakes were released by maintaining a vacuum (partial vacuum) in the brake line of the train. Due to automatic control, the brakes are applied without the driver's intervention (automatically) in case of train breaking and violation of the brake line integrity. Integrity means that the brakes are linked into a single system and are controlled from the locomotive cab by the driver.

In the late 1890s, railway companies began to introduce lighting in passenger carriages, initially in first- and second-class coaches and then in third-class coaches. They used candles and later switched to gas lighting, when cylinders with compressed gas were placed under the coach body. At the beginning of the 20th century, electric lighting with incandescent lamps was installed in first-class coaches. In the first decades of the 20th century, Indian railways continued to use candles and gas lamps in the lower classes, for which purpose compressed luminous gas cylinders were installed in the coaches[23] [18].

The primitive air-cooling systems in compartments of first- and second-class coaches, which used the Sanders system or ice[24] placed in metal boxes in the compartment, were replaced by more advanced air-conditioning (initially only air-cooling) systems in passenger coaches, but still using ice (*Fig. 24*, *25*). Note that in the 1860s, attempts were made across the world to establish industrial manufacture of ice, which is referred to as 'artificial' or 'plant' ice, using different technologies[25]. In the United States, artificial ice began replacing natural ice in the late 1870s. The Bengal Ice Company was the first company in India to start producing artificial ice for sale in 1878 and within four or five years it completely replaced natural ice imported from the USA in the Indian market [19].

An air-conditioned coach fleet developed in India in the same manner as in other countries. At first, there were coaches with air cooling units using natural or artificial ice, which was loaded into large boxes under the body of the coach. The cooled air was directed by fans through ducts to passenger compartments. In the late 1930s, ice-based systems began to be replaced by air conditioners with various mechanical refrigeration units, approaching modern designs.

In the first decades of the 20th century, India developed a passenger transport system that remained in place until the country won independence in 1947 and that, with some subtle differences, has survived to the present day. The carriages were divided into three classes according to the travel conditions, and extra-class luxury saloon carriages were also in operation.

Fig. 24. Delivery of ice to Frontier Mail[26] train coaches at Bayana Junction station. September 11, 1942. About a dozen blocks of artificial ice can be seen on the trolley [2]

Fig. 25. The metre gauge first/second-class coach of a mixed train of Western Railway (WR). On the photo, the third compartment from the left end of the coach (the third door on the left) is equipped with air conditioning (you can see the inscription 'AIR – CONDITIONE' on the wall of the carriage). The ice was loaded into the undercarriage boxes under this compartment. The construction of the carriage is attributed to the mid-1940s. Photo, approx. 1951[27]

First-class bogie coaches with separate private compartments, furnished with handmade furniture, with toilets and sometimes showers, electric lighting and air conditioning were quite comfortable and modern. Low-

[23] Sources refer to the use of paraffin (kerosene) lamps in the early period; however, this is most likely a mistake. In the world practice, paraffin lamps were rarely used for the illumination of passenger compartments of carriages due to high fire hazard from paraffin spillage. Most likely, we are dealing with a terminological confusion and mistakes in translations from one language to another: candles are often referred to as 'oil lamp' and 'kerosene lamp'.

[24] See: Vladislav B. Zakharov, Egor Komarov. Passenger Rolling Stock of Indian Railways in the First Half-Century of Their Operation / BRICS Transport. Scientific and Practical Peer-Reviewed Journal. 2024. Vol. 3. Issue 1.

[25] At the beginning, the production required large capital investments and energy costs. Moreover, initially, it was not possible to produce artificial ice of the same purity, transparency and flavour as natural ice. First of all, artificial ice began to conquer distant markets, for example, in Australia, where out of 400 tonnes of natural ice sent from the USA only 150 tonnes arrived in the form of ice after a 3.5-to-5-months-long trip, while the rest of the ice melted.

[26] Today this train runs between Mumbai Central and Amritsar. It is called the Golden Temple Mail and is one of the most comfortable trains in India.

[27] Kumar R. Harish Gallery • Heritage and History • Bombay Baroda and Central India Railway (BBCIR), 2009. URL: https://www.irfca.org/gallery/Heritage/bbcir/o07.jpg.html

er in comfort were the second-class coaches that were mostly used by wealthy Indians. As late as the end of the 20th century, these coaches also mostly had separate compartments, often with toilets, and were gradually provided with electric lighting. And the third class: still in the first decades of the 20th century, these coaches were biaxial and triaxial, had wooden bodies, doors opening outwards, and simple wooden benches for seating. By the middle of the 20th century, these coaches were gradually reconstructed to accommodate berths for lying down, and had little or no ventilation devices. Illuminated by candlelight or gas lighting, filled with appalling filth brought in by new and new passengers, the coaches were not cleaned for years. From the early 20th century, third-class coaches were gradually equipped with so-called toilets, which almost never had water.

The third class of Indian Railways concentrated all the inhuman policies of the colonisers, and even worse, the attitude of the wealthy Indian countrymen towards the powerless masses of the poorest population of the British colony, the wealth, resources, and strength of which have created the well-being and prosperity of the metropole and provided for the parasitic existence of several generations of white colonisers up to the present day.

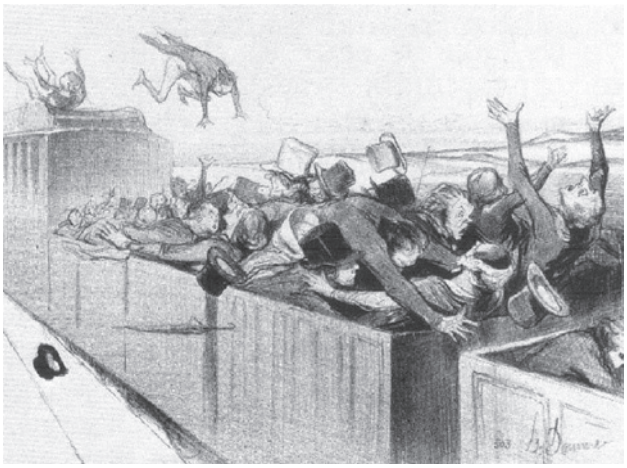

Fig. 26. Honoré-Victorin Daumier (1808–1879). Caricature 'Impressions et Compressions de voyage' (Travel Impressions and Compressions) — Third class on the French railways[28]. 1853

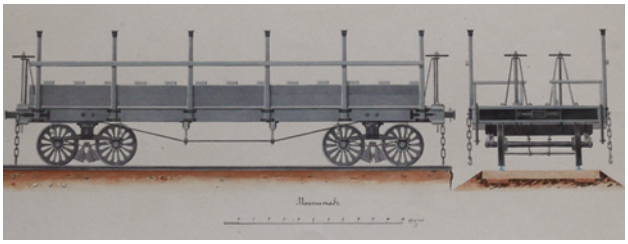

Fig. 27. Third-class open carriage of the St. Petersburg–Moscow railway. 1851. Atlas of the St. Petersburg–Moscow railway of 1851. The carriages were used for several years during the summer period. R&D Library of the Emperor Alexander I St. Petersburg State Transport University (PGUPS)

THIRD CLASS OF INDIAN RAILWAYS IN THE FOCUS OF THE PROBLEMS OF COLONIAL SOCIETY AND INDIAN INDEPENDENCE STRUGGLE

Undoubtedly, there was, and still is, a difference in the level of passenger travel comfort on the railways all over the world. Differences in travel comfort have always existed and continue to exist between cabins of different classes on ships, in horse-drawn carriages of different levels of comfort before the appearance of automobiles, and today in cars of different classes and, of course, in aeroplane cabins of different levels of comfort.

For the purposes of our analysis, it is useful to briefly compare the equipment and levels of comfort for passengers in third-class coaches in different countries during the specified period of time. You will recall that in Great Britain and other countries, including Russia, the first railways used third- and fourth-class carriages, which were open platforms without roof, with low walls and simple benches (berths) without backrests (*Fig. 26*, *27*).

In Great Britain, the Railway Regulation Act of 1844 introduced the first regulations to ensure passenger comfort. In particular, it was decided that passengers in third-class coaches had to be protected from bad weather and provided with seats, etc. [20]. For more than two decades, the owners of railway companies used various pretexts to evade their obligations under the law, but gradually travel in lower class coaches was made subject to the minimum requirements for available services.

In all countries, the struggle between passengers from the lower social strata and railway companies for a decent level of comfort during travelling in fourth- and third-class coaches continued for many decades, and in a certain sense it continues up to now. Numerous works of art — unique documents from the middle to the end of the 19th century — reflect the conditions of travel of the lower classes (*Fig. 28–31*).

This painting is housed in the Metropolitan Museum of Art in New York City and stands as testimony to how access to reliable and comfortable transportation continues to be associated with various manifestations of inequality with regard to large lower-class, declassed and marginalized populations around the world.

[28] URL: https://commons.wikimedia.org/wiki/File:Honor%C3%A9_Daumier_-_Impressions_et_Compressions_de_voyage.jpg

Fig. 28. Honoré-Victorin Daumier (1808–1879).
The Third-Class Carriage. Canvas, oil. 1862–1884[29]

Fig. 29. Vintage illustration "Crowded interior of Third class railway carriage in Spain". A third class railway carriage in Spain. 1890 — stock illustration[30]

By the first years of the 20th century — before the outbreak of the First World War — in the USA and most European countries, the organisation of passenger transportation by rail had improved in the lower classes of service, and more or less stable standards and rules had been established to regulate the level of minimum travel comfort. Several countries abolished the third class on the railways and improved the conditions of travel to the level of the second class, but recurrences of disparaging treatment of passengers from the lower strata of society occurred even in technologically advanced countries, for example, in the USA, Great Britain, and France, up to the middle of the 20th century. The situation was exacerbated by the two world wars, and in the USA, South Africa, and some other countries, it was overlaid with racial segregation even after the end of the Second World War.

In the Indian Railways at the end of the second decade of the 20th century, the attitude of the railway administration and railway employees toward passengers and toward providing the level of comfort of travel for passengers from the lower, poorer classes became politically significant. In 1917, this was reflected in a journalistic paper which today can be rightly classified as a work on the history of the Indian railways and, at the same time, on the history of the political struggle for independence from Britain. Even today,

Fig. 30. Fourth class carriage on Polish railways.
The late 19th century[31]

Fig. 31. Georges Bertin Scott (1873–1943).
A third-class railway carriage in Brittany, France. Lithography.
The late 19th century[32]

[29] The Third-Class Carriage (1863-65) by Honore Daumier. URL: https://www.artchive.com/artwork/the-third-class-carriage-honore-daumier-1863-65/#:~:text=About%20The%20Third%2DClass%20Carriage,during%20the%20industrialization%20of%20Paris
[30] Vintage illustration Crowded interior of Third class railway carriage in Spain, Spanish History 19th Century — stock illustration. URL: https://www.gettyimages.com/detail/illustration/vintage-illustration-crowded-interior-of-royalty-free-illustration/1797253866
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[32] Georges Bertin Scott. A third class railway carriage in Brittany, France. URL: https://www.meisterdrucke.ie/fine-art-prints/Georges-Bertin-Scott/580331/A-third-class-railway-carriage-in-Brittany%2C-France-.html

this paper has lost none of its significance as a poignant socio-political work against the colonial regime. It is a small book, or more precisely, a 31-page brochure by Mahatma Gandhi, *Third Class in Indian Railways* [21].

The thinker, philosopher, and political leader of the 20th century, Mahatma Gandhi[33], saw, in concentrated form, the essence of the terrible British colonial system of oppression, suppression, and humiliation of the indigenous population in the methods of organizing transportation of the poorest part of the Indian population in third-class coaches, devoting his famous book to the analysis of this phenomenon.

At the age of 19, Mohandas Gandhi went to study in London, where he graduated in law and qualified as a barrister. He returned to India in 1891 and went to South Africa in 1893, where he became a successful lawyer representing Indian traders in court processes.

During one of his rail journeys in South Africa, he was thrown out of a first-class carriage by white passengers, although he had a valid first-class ticket. The shock of feeling the injustice of what had happened to him left an imprint on his views and philosophy.

In South Africa, Gandhi first advocated the interests of Indian immigrants based on the ideology of non-violent resistance, implementing the idea of satyagraha (Sanskrit सत्याग्रह, IAST: satyāgraha, 'standing in truth', 'holding on to truth', 'perseverance in truth').

In 1915, at the age of 45, Mohandas Gandhi returned to India and soon began organising a movement of peasants, farmers and urban workers against discrimination and excessive land taxation. He soon became widely known as the spiritual leader of the Indian independence movement and an ardent supporter of civil disobedience as a force for social change. Mohandas Gandhi put his ideas on the tactics of non-violent struggle for independence into practice in two forms: non-cooperation with the colonial authorities and civil disobedience.

In 1917, Gandhi presented his unusual view of the hard living conditions of the poor in India, based on the experience of a railway journey from Mumbai to Madras. This brief brochure, *Third Class on Indian Railways*, which touched on subjects ranging from the filthy, overcrowded conditions in third-class coaches to philosophical reflections on cures for the diseases of an oppressed nation, became a vital work outlining the teachings of one of the greatest thinkers of the 20th century. It is the basis of his researches that made him such a powerful and respectable person.

The author describes his two-day train journey from Bombay to Madras in a third-class carriage as the forty-eight hours of terrifying travel with hundreds of passengers, with whom Mahatma Gandhi endured physical suffering, insults and moral humiliation. *"I have now been in India for over two years and a half after my return from South Africa. Over one quarter of that time I have passed on the Indian trains travelling third class by choice. I have travelled up north as far as Lahore, down south up to Tranquebar, and from Karachi to Calcutta. Having resorted to third class travelling, among other reasons, for the purpose of studying the conditions under which this class of passengers travel, I have naturally made as critical observations as I could.*

I have fairly covered the majority of railway systems during this period. Now and then I have entered into correspondence with the management of the different railways about the defects that have come under my notice. But I think that the time has come when I should invite the press and the public to join in a crusade against a grievance which has too long remained unredressed, though much of it is capable of redress without great difficulty.

On the 12th instant I booked at Bombay for Madras by the mail train and paid Rs. 13-9. It was labelled to carry 22 passengers. These could only have seating accommodation. There were no bunks in this carriage whereon passengers could lie with any degree of safety or comfort. There were two nights to be passed in this train before reaching Madras. If not more than 22 passengers found their way into my carriage before we reached Poona, it was because the bolder ones kept the others at bay. With the exception of two or three insistent passengers, all had to find their sleep being seated all the time. After reaching Raichur the pressure became [Pg. 4] unbearable. The rush of passengers could not be stayed. The fighters among us found the task almost beyond them. The guards or other railway servants came in only to push in more passengers.

A defiant Memon merchant protested against this packing of passengers like sardines. In vain did he say that this was his fifth night on the train. The guard insulted him and referred him to the management at the terminus. There were during this night as many as 35 passengers in the carriage during the greater part of it. Some lay on the floor in the midst of dirt and some had to keep standing. A free fight was, at one time, avoided only by the intervention of some of the older passengers who did not want to add to the discomfort by an exhibition of temper.

Not during the whole of the journey was the compartment once swept or cleaned. The result was that every time you walked on the floor or rather cut your way through the passengers seated on the floor, you waded

[33] Mohandas Karamchand Gandhi, 1860–1948, (the honorific title "Mahatma", from Sanskrit meaning "magnanimous, venerable", first applied to him in South Africa in 1914, is used throughout the world) is one of the leaders of the struggle of the peoples of India for liberation from the British colonial rule, the founder of the ideology of Gandhism, the inspirer of the movement for civil rights and freedoms all over the world. He comes from a family of the Bania mercantile caste — the most influential mercantile and financial caste in India and Nepal, belonging to the Vaishya Varna [22, 23].

through dirt. The closet was also not cleaned during the journey and there was no water in the water tank…" [20].

In the first decades of the 20th century, the struggle for the decent conditions of travel for third-class passengers merged with and became part of the social struggle, one of the forms of resistance against the oppression of the broad masses of the population by colonisers, the struggle for the liberation of India from British colonial dependence, which was clearly manifested in the activities of one of the greatest leaders of our time — Mahatma Gandhi.

CONCLUSION

The liberation of India from colonial dependency in 1947 was followed by the territorial division of the formerly united country into several states according to the plan of the British colonisers, who sought to maintain their de facto dominance in the region. This domination led to bloody ethnic and religious clashes and catastrophic migration of the populations of the newly formed territories. All of those things slowed down the development of Indian railways. Nevertheless, having gained independence, the country got a chance to resolve the accumulated challenges, including those in railway transportation.

In 1949–1950, India's Minister of Transport and Railways, Mr Narasimha Gopalaswami Ayyangar, announced the government's decision to set up its own modern rolling stock production in India to bring an end to the country's forced dependence on foreign manufacturers. In 1955, the first coach factory, Integral Coach Factory (today one of the largest coach factories in the world), was built in Perambur, Madras, Chennai, under an agreement with the Swiss company Schweizerische Wagons- und Aufzügefabrik AG (SWS). This plant started manufacturing modern coaches known as the ICF type, which defined the look of the passenger coach fleet in India for several decades.

The very difficult and long process of radical renewal of the fundamentals of the organisation of passenger transportation on the Indian railways continued under the new conditions. There was a long way to go, several decades, to achieve the goals of liberation from the British colonial legacy of monstrous class division in rail transport, including the infamous and much-speculated 'third class'.

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Locomotives in Service of Space[1]

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Научная статья

Локомотивы на службе космоса[1]

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On June 2, 1955, based on the directive of the General Staff of the Armed Forces of the USSR, the organisational and staff structure of the Research Test Site No. 5 was approved and its headquarters, military unit 11 284, was established. This date is considered the day of foundation of the first Baikonur Cosmodrome in the history of mankind.

At present Russia has such cosmodromes as Baikonur (Russia, Kazakhstan), Kapustin Yar, Plesetsk, and Svobodny. By the Russian Federation Presidential Decree dated November 6, 2007, the construction of another Russian cosmodrome, Vostochny in Amur region, began and was completed in April 2016 [1]. The structure of each cosmodrome includes facilities, utilities, and special equipment necessary for launching boost rockets. They are called sites or positions. There are launch and technical sites, a fueling and neutralisation station, a command and control post, a landing complex, a landing range, a range measuring complex, a material and technical base, and a living area.

The construction of the first Soviet cosmodrome was a competition with nature, an experience that later allowed preserving and multiplying Russia's space glory. The harsh climatic conditions significantly affected the pace of construction. In winter, the sandy soil froze to one and a half meters, so the sand had to be blasted. In summer, the wind in the region became parching: the temperature rose to 50°. The construction was carried out from scratch, in a bleak steppe, the only infrastructure element that existed at that time was the railway. A week after the first builders of the future cosmodrome got off the Orenburg – Tashkent line, echelons with machinery and workforce from all

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Fig. 1. Railway schedule at Baikonur cosmodrome[2, 3]

corners of the Soviet Union began arriving at Tyura – Tam station. Later, the railway started delivering rockets for satellite launches and the spacecraft themselves.

Each site of the test ground began with extending a railway line built by railway troops to it. The first line went from Tyura – Tam station in the northern direction, where the construction of the famous launch site No. 1 began. However, it did not become famous at once, but six years later, on April 12, 1961, when Yuri Alekseevich Gagarin went into space from it. Although this launch pad had the title first number, rocket launches did not begin there. The first launch of the R-7 ballistic missile was carried out from another launch pad on May 6, 1957. By that time, the launch complex, assembly and testing and integration buildings, a concrete road and railway access roads had been built here.

Throughout the history of the cosmodrome until the 2010ies, all movement of cargo, materials and personnel was by railway, and relatively recently bus routes were allowed and organised for Baikonur workers (*Fig. 1*).

Motor locomotives, as Baikonur workers called the trains, consisted of compartment and interregional cars manufactured by Ammendorf (GDR). The trip to work took 1–3 hours depending on the remoteness of the site.

The total length of Baikonur railway is about 470 km. All railway tracks here are not electrified. The choice of the locomotives to provide the traffic is not accidental, because the transported structures are heavy cargo: the platform on which the booster lies, the rocket itself, the spacecraft.

The first locomotives sent to Baikonur were Эу series steam locomotives manufactured by Lugansk Plant (*Fig. 2*). They were used during construction of the cosmodrome and for provision of the first launches.

It should be noted that steam locomotives were not involved in towing the rockets to the launch. They built roads and provided auxiliary traffic. They were replaced with diesel locomotives of ТЭ2 series operating in one and two sections, but their capacity did not prove sufficient (*Fig. 3*).

Fig. 2. Эу series steam locomotives manufactured by Lugansk Plant

[2] Al photos are from: Locomotives in Service of Space. URL: https://opzt.ru/news/lokomotivy-na-sluzhbe-kosmosa
[3] Text of the inscription: TRAIN No.102. Gorodskaya st. – Severnaya st., departure at 5:54. TRAIN No. 101. Severnaya st. Gorodskaya st., arrival at 16:23.

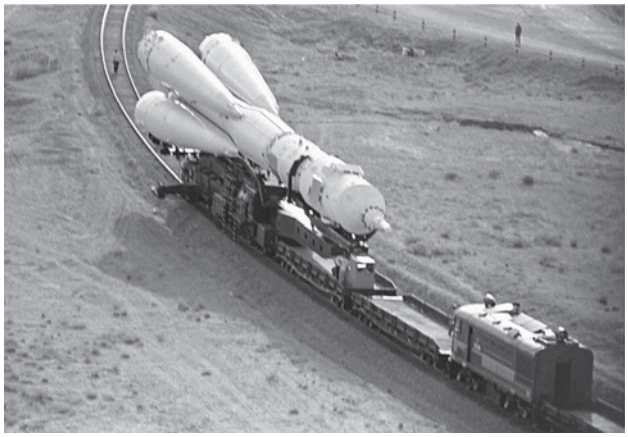

Fig. 3. ТЭ2 diesel locomotive

Fig. 4. Assembled full-scale mock-up of RN (rus. PH) Energy booster: 4M item in the process of transportation with ПТЭ3 diesel locomotives

In 1953, Lugansk plant produced a new locomotive: a ТЭ3 series two-section diesel locomotive with the engine power of 2 × 2000 hp. Mastering of the production of ТЭ3 diesel locomotives with 2Д100 diesel engines ensured the governments planned conversion of railway transport from steam power to diesel operation, and in 1956 the production of steam locomotives in the USSR stopped. From the early 1960ies to the mid-1980ies, ТЭ3 was the main locomotive on non-electrified railways of the USSR [2]. In 1966, the Baikonur management requested Lugansk plant to create a special locomotive for the cosmodrome. In the same year, ПТЭ3 (*Fig. 4*) appeared. Externally, they practically did not differ from their civil counterparts, but inside they had fundamental differences. In the same year a batch of three two-section ПТЭ3 (Nos. 2511, 2512, 2521) diesel locomotives was produced. Structurally, these were serial ТЭ3 which had automatic speed control at 10 km/h and the possibility of synchronous movement of two diesel locomotives on parallel tracks using the multiple unit system (MUS).

Subsequently, the complexes were transported to the tester stations and launch site by two parallel tracks with a center distance of 18 m using two specially converted 2М62 diesel locomotives (*Fig. 5*).

Later on, cosmodromes started using ТЭМ2УМ-201 shunting diesel locomotives produced by Bryansk Mechanical Engineering Plant. This was a consistent modification of ТЭМ2, the most widespread diesel locomotive in the USSR, with a diesel-driven generator capacity of 1,350 hp instead of the standard 1,200 hp due to the use of 1ПД-4А generators (*Fig. 6*).

It is also necessary to recall such an exclusive development as a battery-driven electric locomotive designed for transportation of inflammable and explosive cargoes. Druzhkovka Mechanical Engineering Plant produced three modifications of the electric locomotive for the cosmodrome: 11Т125 — for transportation of Cyclone booster, 11Т756 — for transportation of Zenit booster, 11Т186 — for transportation of Zenit-2 booster (*Fig. 7*, *8*) [3].

In the early 2000ies, the locomotive fleet of the cosmodrome gradually began renewing, and new diesel locomotives of ТЭМ2У and ТЭМ2УМ series were delivered (*Fig. 9*). They have been produced by Bryansk Me-

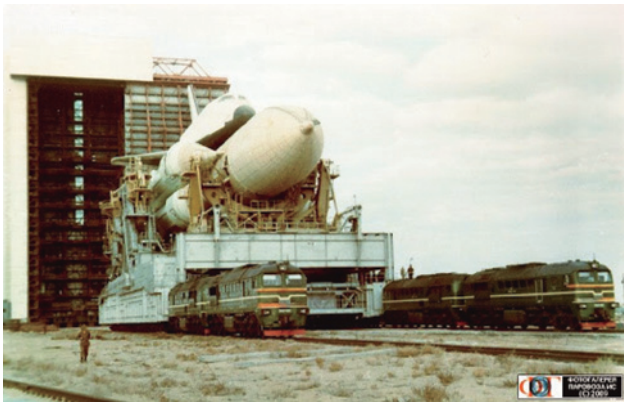

Fig. 5. 2М62 diesel locomotives

Fig. 6. ТЭМ2У diesel locomotive

Fig. 7. 11T125 electric locomotive produced in 1976 with a single-structure body for 11T125 units and T30 electric locomotives in the assembly and testing facility

chanical Engineering Plant. These locomotives started arriving both at Baikonur and Plesetsk cosmodrome. However, the diesel locomotives of this series are no longer used by twos, as ПТЭ3 and 3М62П, but by fours, with one from each corner of the platform.

Vostochny cosmodrome, the youngest of the domestic ones, uses the most powerful shunting diesel locomotives on its railway network: ТЭМ14 (*Fig. 10*). Their capacity is twice as high as that of ТЭМ2 — 2,400 hp [4].

Apart from ТЭМ14, diesel locomotives of ТЭМ7/ТЭМ7А series manufactured by Lyudinovo Diesel Locomotive Plant are also used (*Fig. 11*). Although their capacity is somewhat lower — 2000 hp, the "seventh" has proven itself to be good at large marshalling yards, in specific conditions of open-pit mines and coal pits. The latest video surveillance and pre-start heating systems have been introduced into the diesel locomotive design, which greatly facilitates the work of locomotive crews at the cosmodrome.

Railway transport has played a major role in the formation and development of the Russian space program. However, the role of domestic cosmonautics is also invaluable in the development of railway transportation.

Since 2008, Russian Railway OJSC has been implementing the Strategy for the Development of Railway Transport in Russia until 2030 [5]. This document

Fig. 8. 11T186 electric locomotive in the assembly and testing facility

Fig. 9. Transportation of Soyuz TMA-02M by ТЭМ2У diesel locomotive

Fig. 10. ТЭМ14 shunting diesel locomotive

Fig. 11. ТЭМ7А diesel locomotive

has established the priority areas, including the use of innovations in the industry. In the 2010ies, as part of the implementation of this strategy, the cooperation between railways and space has significantly expanded. One of the areas that is being successfully implemented at present is the implementation of the project for the development of fast and high-speed transportation.

The development of fast traffic necessitates the search for optimal solutions for infrastructure modernization. One of the ways to increase speeds is to increase the unbalanced acceleration in curves with their minimal change. It is in this area that Russian Railways OJSC and Yu. A. Gagarin Research & Test Cosmonaut Training Centre FSBI have been cooperating for several years. Space experience has provided the necessary data to ensure the safety of transportation at high speeds.

To determine the permissible travel speeds with regard to human exposure to unbalanced acceleration and vibrations, Russian Railways OJSC, in cooperation with the Cosmonaut Training Centre, conducted studies that determined the relevant regulatory requirements both for locomotive drivers and passengers (*Fig. 12*).

The result of the set of studies conducted by Yu. A. Gagarin Research & Test Cosmonaut Training Centre FSBI, VNIIZhT JSC, and VNIIZhG Rospotrebnadzor FSUE was the new regulatory requirements that ensure increased permissible passenger train speeds without negative consequences for passenger comfort and locomotive crew performance, while unconditionally ensuring traffic safety. The tests were successfully conducted in the 2010ies using ЭП20 locomotives and TALGO passenger cars (*Fig. 13*). The train ran along the Moscow – Nizhny Novgorod route.

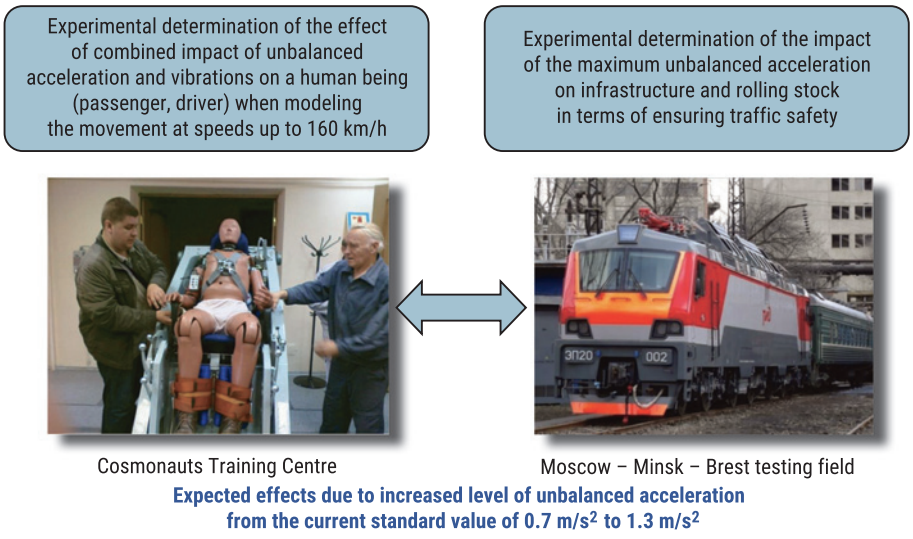

Fig. 12. Development of a regulatory framework for interaction between rolling stock and railway infrastructure

Fig. 13. ЭП20 locomotive

Similar studies of the complex effect of unbalanced acceleration on the human body were previously conducted more than 50 years ago by specialists of Leningrad Institute of Railway Transport Engineers and S.M. Kirov Military Medical Academy.

In 2024, on the eve of the Cosmonautics Day at 12:00:00 Moscow time, the first launch of the Angara-A5 booster with the Orion upper stage and test payload was carried out from 1A site of the newest Vostochny cosmodrome. This was the sixth launch of a Russian booster in 2024, including the second from Vostochny. For Angara-A5, this flight was the fourth in history and the first from Vostochny.

The booster was delivered to the launch complex by ТЭМ series diesel locomotives. In addition, many industrial enterprises of the railway industry contributed to the development flight tests of the Amur space rocket complex with Angara heavy-lift booster at Vostochny cosmodrome. The technological systems for the Angara space rocket complex were designed and manufactured by Uralkriomash JSC (part of Uralvagonzavod Concern JSC).

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ECONOMICS OF INTERNATIONAL TRANSPORT AND LOGISTICS:
INTELLIGENT AND DIGITAL SOLUTIONS AND PRACTICES
ЭКОНОМИКА МЕЖДУНАРОДНЫХ ПЕРЕВОЗОК И ЛОГИСТИКИ:
ИНТЕЛЛЕКТУАЛЬНЫЕ И ЦИФРОВЫЕ РЕШЕНИЯ И ПРАКТИКА

Original article
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Technological solutions in the field of transport logistics

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ABSTRACT Transport logistics is the dominant process of supply, which includes planning, execution and control of the movement of goods and services. The study examines the processes of digital transformation of the Russian transport and logistics industry. A number of current trends are analysed, such as electronic transportation documents (for all modes of transport), the development of delivery systems and logistics of marketplaces, and the beginning of large-scale commercial operation of unmanned aircraft systems. It is noted that special software and AI reduce data processing time and can perform those tasks that were previously performed by people, thereby speeding up logistics processes and reducing related costs. It is quite obvious that processes that previously required a significant time can be optimised by reducing it. The use of methods of analysis and synthesis, comparisons and generalizations in combination with a systematic approach to the study allowed us to consider the processes of digital transformation of the transport and logistics industry and their fusion on the effectiveness of logistics processes from different points of view and approaches. The demand for digitalisation in the transport and logistics system is due to the constantly growing need for the delivery of goods, regardless of the geographical distance between the counterparties. The use of modern technologies in transport logistics is likely to be able to scale supply chain processes with a significant reduction in time lag. IT technologies are the key to improving the efficiency and competitiveness of transport logistics. The paper substantiates the need to implement advanced IT solutions that will allow companies to optimise their logistics operations, improve the quality of customer service, and reduce costs.

KEYWORDS: transport logistics; transport flow; supply chains; information technology; management system; digital integration

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Научная статья

Технологические решения в сфере транспортной логистики

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АННОТАЦИЯ Транспортная логистика является доминантой процесса поставок, который включает планирование, выполнение и контроль перемещения товаров и услуг. Рассматривается цифровая трансформация российской транспортно-логистической отрасли. Анализируется ряд актуальных трендов: электронные перевозочные документы (на всех видах транспорта), развитие систем доставок и логистики маркетплейсов и начало массовой коммерческой эксплуатации беспилотных авиационных систем. Специальное программное обеспечение и искусственный интеллект сокращают время обработки данных и могут выполнять задачи, ранее выполняемые работниками, тем самым ускоряя логистические процессы и снижая соответствующие затраты.

Очевидно, что процессы, ранее требовавшие значительного временного интервала, могут быть оптимизированы в части его сокращения. Использование методов анализа и синтеза, сравнений и обобщений в совокупности с системным подходом к изучению позволило с разных точек зрения и подходов рассмотреть процессы цифровой трансформации транспортно-логистической отрасли и их слияние на эффективность логистических процессов.

Востребованность цифровизации в транспортно-логистической системе обусловлена перманентно растущей потребностью в доставке товаров независимо от географической удаленности контрагентов. Применение современных технологий в такой сфере как транспортная логистика с большой долей вероятности способно масштабировать процессы цепочки поставок со значительным сокращением временного лага. IT-технологии являются ключом к повышению эффективности и конкурентоспособности транспортной логистики. Обоснована необходимость внедрения передовых IT-решений, которые позволят компаниям оптимизировать свои логистические операции, повысить качество обслуживания клиентов, а также снизить расходы.

КЛЮЧЕВЫЕ СЛОВА: транспортная логистика; транспортный поток; цепочки поставок; информационные технологии; система управления; цифровая интеграция; транспортные перевозки

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INTRODUCTION

Transport logistics is rightly perceived as a dominant component of the supply process which involves planning, execution and control of the movement of goods and services between counterparties. Much importance is attached to coordination of various activities, including transportation, warehousing, inventory management and distribution, to ensure timely delivery of products to potential consumers.

Transport logistics is an integral part of the national economic system at all of its hierarchical levels. Without using it, the performance of the communication processes between producers and consumers does not seem possible. The development of transport and logistics systems is a guarantee of the competitiveness of the state both in the national and global markets.

POSSIBILITIES OF TRANSPORT LOGISTICS

Transport logistics allows business entities to optimise deliveries, reduce transport costs and improve inventory management [1].

An analysis of the freight transportation market has shown the trends towards its expansion, which is reflected in official statistics. In 2021, the global freight traffic was estimated at $14.85 bln; and by 2030, according to expert forecasts, it will amount to $21.08 bln with a CAGR (Compound Annual Growth Rate) of 4 %.

The following parameters should be taken into account in the framework of actions to address the issue of differentiating the modes of goods transportation:

- the nature of the product;
- the distance to be covered;
- the urgency of delivery.

As practice shows, the commonest modes of transport are air, sea, road, and rail.

Air transport is appropriate for expensive and urgent transportations, while sea transport is good for significant volumes that do not have priority requirements in terms of urgency.

Road transport is used for short- and medium-distance transportation, while rail transport is suitable for the transportation of bulk goods over significant geographical distances.

When addressing the task of minimizing transport time and costs, business entities develop approaches to optimise future routes. Transportation Management Systems (TMS) and software are used to optimise routes, to plan and improve transport routes, which helps to reduce transport costs, shorten the time lag of goods delivery and increase the satisfaction of potential consumers.

Revolutionary changes in the transport and logistics system are initiated by technological solutions which have become possible due to the scientific and technological advances: from the automation of inventory management to the use of artificial intelligence (AI) algorithms within route optimisation.

With the increasing complexity and unpredictability of the external environment, it is expedient for business entities to initiate the practical implementation of advanced technologies, including data analytics, AI and automation, within the shortest time possible.

Such technological solutions are designed to address the tasks of tracking and monitoring in real time, of sound demand forecasting, optimised inventory management, and reducing an order processing lag, which ultimately leads to increased satisfaction of potential consumers and optimization of the core operations.

The field of transport and logistics systems is currently witnessing growth of technology offers designed to address the problems of optimising and rationalising the existing operations within the evaluation criteria. From AI to autonomous vehicles, these trends are radically changing the ways goods are transported, tracked and managed [2, 3].

Let us consider the most important technological solutions in the transport logistics industry.

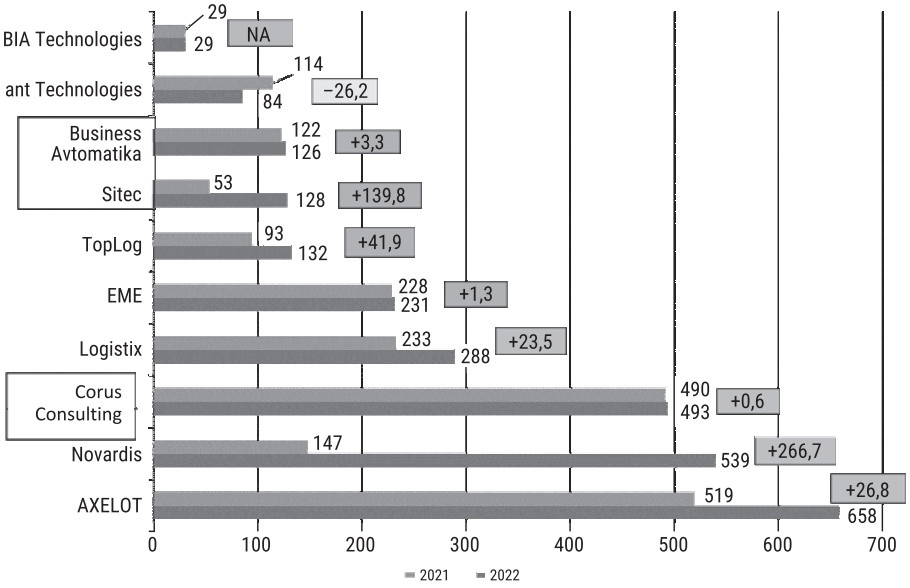

Fig. Major suppliers of warehouse management systems in Russia in terms of revenue in 2022, RUB mln

1. Automation of warehouse management processes.

A Warehouse Management System (WMS) is a software solution providing an overview of the enterprise's inventory and making it possible to manage order fulfilment at all stages of delivery from the distribution centre to the store shelf.

WMS solutions also enable companies to maximise the use of labour, space and equipment investments through coordinating and optimising resources and material flows. These systems are designed to support the needs throughout the global supply chain, including distribution, manufacturing, and capital-intensive businesses, as well as service companies [4, 5].

In the context of the present dynamic, multi-channel, complex economy, consumers initiate the possibility of purchasing goods without being bound to time and geography.

To solve these problems, warehouse management software designed to optimise fulfilment operations is used.

Import substitution has become an integral part of the development strategies of business entities, influencing the choice of WMS solutions. It is obvious that with foreign suppliers having left the market, domestic companies have an opportunity to put their own solutions into practice in the new competitive field of the WMS market [6].

In 2022, for example, the growth of the Russian market of WMS systems amounted to 25 % or 3.1 bln roubles, which is due to import substitution processes with the account of the reorganisation procedures in the format of mergers and acquisitions (M&A). Such strategic decisions have created prerequisites for strengthening the competitive position of domestic business entities in the core markets with a possibility of achieving the emergence effect.

Of particular note is the fact of growth of the cost of labour force involved in warehousing operations, which is due to the current migration outflow.

Despite the current unfavourable external factors, the Russian WMS market has generally maintained its position and has favourable prospects for further development. It was noted that the support of the Government and the Ministry for Digital Technology, Communication and Mass Media had a positive impact on the entire IT industry[1] (*Fig.*).

The main trend in 2023 was an increase in demand for domestic WMS as part of their substitution for previously used foreign products.

2. Use of transport flow management systems.

A Transport Management System (TMS) is a software package that helps logistics companies to manage and optimise transport operations, which includes such functions as route planning, load optimisation, carrier selection, freight auditing, and payment. A TMS enables companies to increase transportation efficiency, reduce costs and improve customer service through transparency and control of shipments[2] [7].

[1] Decree of the President of the Russian Federation of 02.03.2022 No. 83 "On measures to ensure the accelerated development of the information technology industry in the Russian Federation".
[2] Order of the Government of the Russian Federation of 03.11. November 2023 No. 3097-r "On approval of the strategic direction in the field of digital transformation of the transport industry of the Russian Federation until 2030".

Sometimes referred to as a transportation management solution or transportation management software, a TMS provides visibility of daily transport operations, trade standards compliance documentation and information, and timely delivery of freight and goods. A transportation management system also optimises the shipping process and makes it easier for businesses to manage and optimise transport operations by land, air or sea.

Transportation management systems are mostly used by companies that need to ship, transport and receive goods on a regular basis, including:

- manufacturers;
- distributors;
- e-commerce companies;
- retailers.

Companies providing logistics services include both providers of comprehensive third-party logistics services and providers of system-integrated logistics services (3PL and 4PL), as well as providers of traditional logistics service (LSP).

The transport management system considered finds its practical application in business entities regardless of their industry, be it construction, biomedical, etc.

3. Goods monitoring and tracking technology.

Modern technologies have revolutionised goods tracking and monitoring, offering new approaches to supply chain management and transport logistics. Such innovative solutions are initiating changes in the way goods are transported, monitored and managed, regardless of the geographical factor.

One of the most significant achievements is integration of IoT (Internet of Things) devices. Such sensors and connected devices are embedded in shipping containers, trucks or warehouses ensuring collection and transmission of real-time data, monitoring temperature, humidity, GPS (Global Positioning System) location and events related to impacts or unauthorized access, ensuring the integrity and security of goods throughout their route. IoT-based goods tracking systems provide detailed information on the condition of the goods, allowing for proactive decisions and reducing losses due to spoilage or theft.

The blockchain technology has also become a turning point in goods tracking, offering a secure and unalterable register to record every stage of the supply chain, from production to delivery. Its claimed transparency and reliability increase accountability and ongoing control, reducing cases of fraud and disputes. Smart contracts built on blockchain automate payment and compliance processes, optimising transactions and reducing paperwork [8].

Artificial Intelligence and machine learning are used to analyse large volumes of data generated by goods tracking systems. Predictive analytics can forecast potential delays, optimise routes and identify patterns in goods behaviour, which improves the economic efficiency and profitability of transport and logistics systems.

Drones and autonomous vehicles currently being of significant interest provide fast and cost-effective last-mile delivery and access to remote or inaccessible geographical areas. These technologies both speed up the delivery process and reduce the environmental impact of logistics operations [9].

It can be stated that the transformation processes taking place in transport logistics contribute to its progressive development and lead to the achievement of positive results. The Internet of Things, blockchain, AI, and automation processes increase the transparency, efficiency, and safety of the transportation industry, benefiting both business entities and potential consumers by ensuring timely, reliable, and safe goods delivery.

4. Processes of practical application of analytical data in making relevant management decisions.

Companies show an appropriate interest in data analytics, which can be considered as a global trend. Big data analysis has a steady demand in various spheres of activity, having proved its appropriateness and relevance within the framework of economic activity.

In practical application, these tools offer great opportunities for solving the problem of improving the efficiency of supply chains in transport and logistics activities, directly affecting performance in this area.

The efficiency of logistics processes largely depends on the information component, which predetermines the relevance of approaches based on big data analysis.

According to experts' estimates, Big Data management systems and their effective implementation for the transport industry will bring its benefits.

Big Data is a concept used to describe a considerable amount of both organised and unstructured data that emerges due to the increasing use of social networks, mobile devices, and the Internet of Things in real time [10].

The complexity of coordinating a multitude of interrelated processes in the area under consideration contributes to the formation of problem areas with negative consequences.

Thus, in order to level out such phenomena, it is expedient to apply Big Data tools in practice, including within the framework of supply chain management, by creating a comprehensive and responsive network of strategic management of material, information and financial flows; inventory control aimed at maintaining an optimal balance of supply and demand, while minimising storage costs and ensuring product availability; optimising logistics processes of transportation, warehousing and distribution; and ensuring timeliness and reducing the lead times. The predominant goal should be to create a sustainable, flexible and economically effective system adapted to changes in market conditions and providing appropriate value to all stakeholders [11].

It is reasonable to highlight a number of advantages of using IT in the transport and logistics industry, including:

- achievement of economic efficiency, manifested in the fact that permanently improving freight exchange platforms guarantee that trucks will have the appropriate load; automated warehouse management leads to reduced labour costs, reducing the degree of inconsistency in cargo handling; and AI-based route optimisation reduces time intervals for goods delivery;
- saving financial resources through efficient planning of goods delivery processes, resulting in lower fuel costs. We should note the role and importance of electric vehicles which are to a certain extent not subject to the stated phenomenon due to their functional difference;
- improved data security because cloud and fog computing significantly reduce the likelihood of hacking into information processing systems. On the other hand, blockchain-based tracking ensures that the data collected about a shipment, from the sender to delivery, is true and accurate.

The following trends are predictable within the frames of transport logistics development in the near future (2024–2025)[3]:

- continuation of digital industry-specific trends of 2022–2023;
- national adaptation of the world's best practices;
- responding to short-term and long-term industry-specific challenges.

The current trends, the development of which will be continued, include:

- import substitution;
- cybersecurity and data protection; and
- development of digital competencies of companies.

In the context of the development of digital technologies, cybersecurity issues are of primary significance. This is confirmed by the interest on the part of business entities that can be currently observed in the subject area, due to the growing scale of cybercrime and cyberterrorism penetrating the ongoing business processes[4] [12].

CONCLUSION

We can confidently state that modern technological solutions are an integral part of the transport and logistics industry, contributing to its progressive development in the long term.

These trends and tendencies will continue to grow, creating a solvent demand on the part of all stakeholders. The key to successful development of the transport logistics industry is a timely response to the current changes and practical use of modern achievements of scientific and technological progress in the relevant segments and areas of activity.

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An International Research and Educational Dialogue with BRICS Countries

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Международный научно-образовательный диалог со странами БРИКС

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The importance of BRICS countries in the global economy is well known. Maritime trade has the primary influence on the development of the world economy and largely determines both the success of development and the sovereignty of countries.

The functioning of the fleet is based on a regulatory and legal framework, including international agreements. Training of national personnel is important; therefore, in modern shipbuilding and training of professionals the assessment of the state and prospects of maritime transport development should be comprehensive.

In terms of the capacity of the national maritime merchant fleet, the BRICS countries are non-uniform. According to the results of the UN Conference on Trade and Development, in 2023, 18.6 % of the 2.25 billion tonnes DWT of the world fleet was controlled by the PRC, including 5.2 % by companies based in Hong

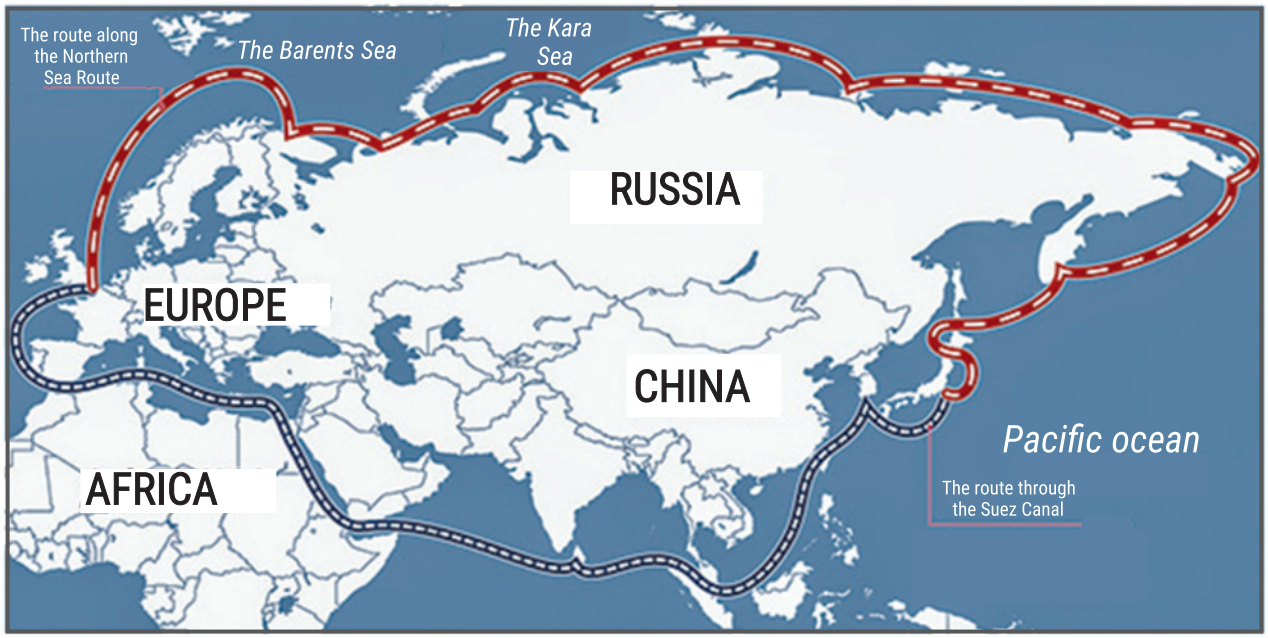

Fig. 1. Comparison of sea routes from Europe to South-East Asia via the Suez Canal and sailing along the Northern Sea Route

Kong. The share of India is 1.4 %, the share of the Russian Federation is 1.0 %, and that of Brazil is 0.6 %. South Africa is not in the list. China is the only country with a maritime fleet fully diversified in terms of transporting any foreign trade cargoes and participates in the export of maritime transport services. It should be taken into account that Russia, India, and Brazil are traditional maritime countries and until 30 years ago, they had a much larger share of participation in maritime trade.

The BRICS maritime transport market is operating under sanctions and restrictions imposed by unfriendly countries. Despite the fact that such actions are mainly directed against the Russian Federation, they affect other BRICS countries as well. Overcoming the sanctions barriers is primarily in the sphere of resolving issues related to financing, international settlements, and insurance of marine vessels and shipping.

The statistics on Russia's foreign trade show that it remains at the same level in terms of volumes but changes geographically. BRICS countries account for a significant share of trade. It is obvious that under the sanctions, most cargo is transported by vessels of companies of friendly countries. But as a result of globalisation, since the mid-1990s, there have been mass mergers and acquisitions of liner companies, and an oligopoly of several large container operators from unfriendly countries has emerged. As the events of the recent years have shown, these companies are a reliable instrument of the policy of unfriendly countries and pose a certain threat to all BRICS countries.

Thus, cooperation with BRICS countries in the maritime industry should follow several interrelated directions. It requires bringing the regulatory and legal framework in line with the current and future needs; modernization of intergovernmental agreements in the field of shipping; cooperation in the form of joint pools, services and enterprises; qualitative and quantitative development of the fleet in different segments with account of the needs of trade; digitisation of processes on the basis of technological algorithms with account of the geography of maritime trade. The solution of these tasks requires the availability of trained personnel, including both sailing specialists and those having the necessary legal, financial, and technical knowledge, well-versed in the algorithms of transport processes and maritime shipping technology.

Russia is actively reorienting its transport and logistics flows towards reliable foreign partners, including those from BRICS countries. Our flagship projects include the Northern Sea Route (NSR) and the new North-South International Transport Corridor (ITC). These two through arteries are designed to provide the shortest and most economically optimal trade routes connecting major industrial, agricultural and energy hubs with consumer markets.

The Resolution of the Government of the Russian Federation dated August 01, 2022 approved the Northern Sea Route Development Plan until 2035. The NSR infrastructure development involves the construction of fuel terminals, hub ports for linking with road and railway lines; the icebreaker fleet is being expanded, primarily by nuclear-powered vessels which are unparalleled in the world.

Other Asian countries (Japan, South Korea, the Philippines, Taiwan and ASEAN countries), as well as many

European countries, are also interested in turning the NSR into a real transport link between the Asia-Pacific region and Europe. This is related to the expected growth of cargo flows between Europe and Asia. It is assumed, for example, that by 2040 the volume of container traffic between the two continents will triple. The Northern Sea Route may become an alternative to traditional sea routes between Europe and Asia.

The North-South Transport Corridor will connect Russian ports on the northern seas and the Baltic Sea with sea terminals on the Persian Gulf and Indian Ocean coasts, and in future it will be able to ensure the annual transit of up to 30 million tonnes of cargo. Russia, together with its BRICS partners, is working on accelerated development of the North-South transcontinental corridor.

Russian President Vladimir Putin proposed to establish a permanent transport commission within the BRICS framework to deal both with the North–South project and, in a broader sense, with issues of the development of logistics and transport corridors, both interregional and global.

The North-South ITC (an alternative to the Suez Canal) provides a link: European Russia — southern Russia, southern Russia — southern Iran, and southern Iran — access to the Persian Gulf.

The State University of Maritime and Inland Fleet is the oldest transport university in Russia. In 2025, we will celebrate our 245th anniversary. The structure of the university includes 4 institutes: the Maritime Academy, the Institute of International Transport Management, the Institute of Water Transport, and the Institute of Advanced Professional Education, as well as 6 branches, most of them located in the Arctic and sub-Arctic zones of the Russian Federation. About 12 thousand cadets and students study at the University. The number of the teaching staff is more than 700 people, 66 % of them are doctors and candidates of sciences.

The issue annually faced by the University is the enrolment campaign for foreign applicants. The University actively attracts foreign students to study under its Bachelor and Master Degree programmes. About 300 students from 32 countries, including BRICS countries, are currently studying at the University. For example, the number of students from Egypt under higher professional education programmes is 33. Since 2020, 17 specialists from Egypt have undergone a competence development programme for ship crew members at the University's Institute of Advanced Professional Education.

The key priorities and areas of development of international activities at the University for the effective development of international cooperation are as follows:

- promotion of priorities and interests of Russian transport education in BRICS countries;

Fig. 2. Cadets in sailing practical training

- expansion of cooperation with leading Russian and foreign organisations, educational institutions, scientific schools, companies, foundations, and business entities;
- training of qualified personnel for enterprises and organisations of water transport and BRICS development.

The State University of Maritime and Inland Fleet uses its resources to fulfil a wide range of tasks, from training maritime personnel for work at sea to training of specialists in navigation.

The University carries out a number of scientific studies in the field of maritime and river transport. Based on the scientific competences formed over the many years, it is possible to identify the key areas for scientific and technical cooperation:

- research of the NSR marine transport system;
- development of autonomous navigation technologies;
- modelling of the process of vessel movement in confined areas using navigation simulators;
- research of the speed performance and seaworthiness of designed vessels;

Fig. 3. Trial basin of the University

Fig. 4. Research wind tunnel of the University

- assessment of the technical condition of navigation and harbour hydraulic structures;
- economic feasibility of investment projects for inland waterways infrastructure development.

BRICS countries appear to be able to identify relevant topics and determine the formats for cooperation in one or more of these areas.

Based on the experience of cooperation with India with regard to research to ensure growth of inland waterway traffic, the key areas of cooperation have been identified. In order to achieve sustainable growth of traffic, it is necessary to systematically address a set of issues related to ensuring the guaranteed dimensions of navigable channels, removal of infrastructure constraints, optimisation of the fleet composition and structure, introduction of digital technologies, use of environmentally friendly fuels, etc. Another topical issue is the development of transport and logistics schemes for cargo delivery to increase the competitiveness of water routes. The university staff has extensive experience in carrying out scientific research. In our opinion, these topics may be of interest for colleagues from Brazil.

The University has extensive laboratory research and simulator facilities, including for laboratory research of the seaworthiness of vessels, technology for repair of machines and mechanisms, and a hydraulic engineering laboratory.

A set of measuring instrumentation for speed, manoeuvrability and sea trials of vessels along with parameter sensors for data collection, processing and analysis allows for comprehensive delivery and research full-scale trials of ships with the presentation of test results in the course of trials.

The State University of Maritime and Inland Fleet has many years of experience in cooperation with BRICS countries both in the fields of education and science, and in the cultural and humanitarian sphere.

The State University of Maritime and Inland Fleet has been cooperating with the Shanghai Maritime University since 2016. More than 20 students of the Makarov University have undergone short-term internships at the University of the People's Republic of China.

The University has been a member of the Association of Rectors of Transport Universities of Russia and China since 2019. The results of the University's participation in the Forum of Rectors of Transport Universities of Russia and China were the signing of a memorandum of understanding with Dalian Ocean University. With a view to further joint work with China, a number of agreements with multilevel transport universities of China in the field of education and research cooperation in the transport sector have been identified.

The work to establish cooperation with India is carried out through interactions with the Embassy of India in Moscow and the Consulate of India in St. Pe-

Fig. 5. Experimental vessel with a solar power source

tersburg in the cultural and humanitarian sphere: in spring 2023, the Embassy of the Republic of India in Moscow held a working meeting with representatives of the Directorate General of Shipping and the Ministry of Shipping of India on training Indian sailors to work in polar waters.

Today, the University cooperates with shipping companies of the Middle East: cadets of the University undergo practical training in sailing on vessels of Koban Shipping LLC within the framework of an international cadet programme.

The professional competence of students and graduates of the State University of Maritime and Inland Fleet allows them to successfully undergo practical training and work in research and design organisations, sea and river ports, brokerage and forwarding companies, as well as in federal government bodies and administrative agencies of constituent entities of the Russian Federation.

We offer our foreign partners the following areas of cooperation:

- use of scientific potential for the development of Brazil's inland waterway systems, design of hydraulic facilities of the port infrastructure;
- development of cooperation with universities of BRICS countries in the field of training personnel for the maritime industry;
- organisation of sailing practical training for cadets on vessels of companies from India and the UAE;
- organization of advanced training courses for specialists from BRICS countries to work in the polar waters of the NSR;
- expansion of the geography of students from BRICS countries.

Bionotes

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