



RESTORING RAILWAY TRANSPORT IN POST-WAR UKRAINE



What Needs to Be Done

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INTRODUCTION

The reconstruction of Ukraine will require not only the restoration of the destroyed infrastructure that existed before the beginning of the large-scale Russian invasion. To a greater extent, it is a question of how to modernize, as well as improve the level of quality and safety.

Railway transport is one of the most important segments of the country's infrastructure, which provides the lion's share of freight turnover (60–75%). It is also one of the most reliable modes of transport for passenger transportation: tens of millions of people use it every year.

However, Ukrainian railway has been in need of large-scale renewal and reform for many years. Despite the commencement of reforms in the field of railway transport, this process has not been completed. Most of the reforms defined by the Association Agreement between Ukraine and the European Union have not been implemented. The issue of integration of Ukrainian railway into the unified transport network of the European Union has not yet been resolved.

The experience of overcoming the railway transport crisis in different countries can help develop an effective strategy for reforming the railway transport of Ukraine and create an efficient and modern railway that meets the requirements of EU legislation.

Purpose of this research:

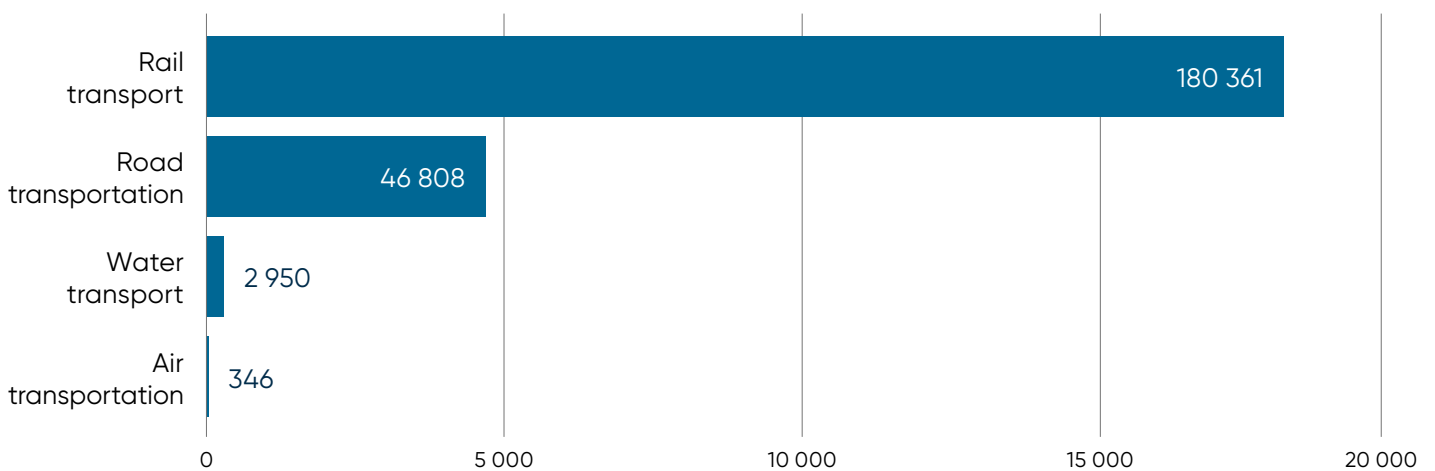
- to determine the current state of railway transport in Ukraine;
- to analyze the experience of the world's railways, in particular, to overcome the challenges and risks that Ukrainian railway currently faces;
- to identify the main steps to develop and reform railway transport for the Government of Ukraine, considering the needs of the state and its population.

CHAPTER 1. PRE-WAR STATE OF RAILWAY TRANSPORT IN UKRAINE

1.1 Role of rail transport

Rail transport in Ukraine plays an important role in passenger and freight transportation. Before the beginning of the large-scale invasion, **60–75% of freight traffic (cargo turnover) and approximately 25% of passenger traffic in Ukraine accounted for railway.**

Structure of cargo turnover of Ukraine for 2021, mln. tkm



Data – [State Statistics Service](#)

While the global role of rail transport in Europe is [gradually decreasing](#), as it does not withstand competition with road and air transportation, for the Ukrainian economy, the significant role of rail transport is still characteristic.

The share of rail freight for the EU [is only 12–18%](#) of all modes of transport. The European Union [is making efforts](#) to increase this share to 30% by 2030. This is expected to reduce greenhouse gas emissions by approximately 275 million tons of CO₂ and lower the consumption of carbon fuels in the transport sector.

Joint Stock Company (JSC) Ukrainian Railways remained the largest freight carrier in Europe until the beginning of the full-scale war. For 2021, the volume of cargo transportation of Ukrainian railway is [180.4 bln tkm](#), while the volume of transportation of all such EU railways is [399 bln tkm](#).

The important role of rail transportation in Ukraine is associated with the following geographical and economic features:

- lower population density and long distances between regional centers, as a result – longer logistics routes;
- a large [share of raw materials](#) in transportation, for which railway is a more efficient way of transportation;

<i>EU rail volumes compared to Ukraine (2021)</i>	
Ukraine	180.4 bln tkm
Germany	123 bln tkm
Poland	123 bln tkm
France	36 bln tkm
Spain	10.5 bln tkm
EU total	399 bln tkm

- the impact of seasonal factors on transportation (in particular for agricultural products);
- a significant role of railway in the transportation of products for export (sender-railway-ports).

Title	Indicator of Ukrainian railways (as of 2014–2019)
Length of rails	21,733 km (12th in the world)
Freight turnover	180 bln tkm (7th in the world)
Market share of cargo transportation in the country	60–75%
Number of passengers transported	81.3 mln passengers (2021)
Passenger market share	25%
Maximum speed	Up to 160 km/h
Number of stations	1,450
Number of employees	More than 230,000
Position in the railway infrastructure quality ranking	32

However, in recent years, road transport has gradually begun to displace rail from the cargo transportation market. This was contributed by a number of both positive and negative factors:

- better condition of roads due to an increase in the volume of roadway repairs and, as a result, a decrease in transportation time for road transport;
- lack of an effective global system of weight control on roads, which allows dishonest carriers to understate costs by overloading the vehicle (the automatic weighing mechanism in Ukraine was launched only in 2021, but is still [at the initial stage of implementation](#));
- ineffective tariff policy of the government in the field of freight rail transportation (for different cargoes, the cost of transportation was different, but the highest tariffs are set on cargoes for which road transportation is a direct alternative);
- difficulty in accessing rail services and slow execution of transportation requests.

Maintaining a high share of rail transport has its advantages because railway has a significantly lower carbon footprint per unit of transport work compared to cars. If the degree of electrification of railway is ensured up to 80%, the level of carbon footprint for railway transport can be reduced [5-10 times](#) compared to road and air transportation. This is particularly important for the cargo transportation sector, which accounts for the largest share of fuel consumption during transport operations.

Rail transport also requires less investment per unit of transport work and carries less burden on taxpayers.

The average cost of building a road in the EU is [4-12 mln euros/km](#), and the cost of building a railway track is from [5 mln euros/km](#) for freight traffic (for speeds up to 120 km/h). However, the resource of the railway track allows transporting three times more cargo with lower operating costs than the cost of maintaining a highway.

Maintenance and repair of railway infrastructure occurs mainly at the expense of service consumers. The maintenance of roads mostly falls on the national and local budgets, and special taxes and duties often do not cover the real costs of maintaining the country's road infrastructure.

Finally, **rail transport is the most priority mode of transport for the state**, especially in the segment of cargo transportation. But it can lose to the road transport if the speed and accessibility of railway are worse.

The share of rail transportation in Ukraine may gradually decrease with the expansion of production with higher added value, since for it, the speed, flexibility, and mobility of transportation are usually more important than the cost. However, it is advisable to preserve the role of the railway in the transportation of raw materials and agricultural products in order to reduce the burden on roads, minimize harmful emissions, and ensure the stability of seasonal transportation.

The loss of the role of railway in the cargo transportation market will increase road transportation fourfold. This will accelerate the deterioration of the roadway and proportionally increase the cost of maintaining roads. Since road infrastructure requires significant investments even now, such a redistribution of cargo turnover can become a burden for the national budget in the medium and long term.

But for railway transport to retain its role, it needs to be reformed and significantly modernized.

In the field of passenger transportation, the railway is usually considered as an intermediate option between road and air transport: it is more comfortable and faster than buses, but cheaper and more affordable than airplanes.

However, **Ukraine has a relatively low level of passenger rail transportation service:**

- There is no high-speed rail traffic, which is faster and more comfortable for connecting remote regional centers (the average speed of passenger trains is [50-60 km/h](#), so the duration of trips may be longer than bus transportation);
- The high-speed network (Intercity+) does not connect all regional centers with the capital;
- Low level of comfort on regional and suburban trains;
- Obsolete design requirements for passenger cars (lack of pneumatic suspension, modern heating, and air conditioning systems, poor technical condition of [most of the existing fleet](#) of passenger cars).

If we compare it with passenger transportation in the EU countries, then a significant part of transportation in France, Germany, or Spain (close in area to Ukraine) is made up of high-speed routes.

High-speed transportation on the French TGV lines carries [approximately 110 mln](#) passengers per year, which exceeds the total passenger traffic of Ukrzaliznytsia.

Ukraine launched approximately fifteen Intercity+ trains at speeds up to 160 km/h. They carry out transportation by common railway lines. However, their average speed usually does not exceed 90–110 km/h, while high-speed trains in France can travel at an average speed of 200–250 km/h.

In general, **the average speed of passenger railway traffic in Ukraine is two to three times lower than in similar EU countries in terms of territory and population.** This significantly hinders the development of rail passenger transportation and limits the opportunities for competition in the market.

1.2 Key issues and challenges

The key issue of Ukrainian railways, which must be solved during the reconstruction of the country, is **the transition from the outdated and deteriorated infrastructure of the USSR standards to the modern – European one.**

Ukrainian railways use outdated technologies with a high degree of deterioration. This applies to both gauge standards and alarm systems, traffic safety, logistics, and dispatching of transportation, rolling stock. In fact, the railway infrastructure of Ukraine needs a large-scale restructuring and, accordingly, global investment and a long period of time.

The experience of other countries has shown that such a process is accompanied by significant risks and requires an effective strategy. Such examples will be discussed in detail in the second section.

The Ukrainian railway market is also characterized by other problems:

- Excessive role of the state, in particular where there is competition on the part of private business (state-owned JSC Ukrzaliznytsia remains the largest operator of freight cars, more than a hundred private operators compete with it);
- Lack of clear and predictable mechanisms of state regulation (especially regarding the determination of tariffs for cargo transportation);
- Difficulty for private investment to access the infrastructure and traction rolling stock (lack of private locomotive operators, high monopolization of services by the state-owned JSC Ukrzaliznytsia).

These problems arose due to the fact that the management structure and approaches to state regulation of the Ukrainian railway have been preserved since the planned economy of the Soviet Union.

In particular, the railway transport of Ukraine does not meet the fundamental requirements of the [Directive of the European Parliament on the creation of a single European railway space](#) and the standard management approaches of European railway companies:

Consequently, **for further integration with European transport networks, rail transport requires large-scale reforms in accordance with the requirements and standards of the EU.** The government should introduce these changes to prepare for the reconstruction and fulfilling the implementation plan of the Association Agreement with the EU.

EU railway practice	Justification	Implementation in Ukraine
Separate railway infrastructure operator	<p>Equal access to the infrastructure of all market participants.</p> <p>Determination of direct fees for the maintenance of infrastructure. Prevention of cross-subsidization of various types of railway services</p>	<p>N/A</p> <p>In accordance with the Action Plan for Railway Transport Reform, a separate infrastructure operator was to be created during 2020–2022. But the plan was never implemented.</p>
Mechanism for revision of regulated tariffs for railway services	A predictable and clear process for determining the cost of railway services in accordance with the pricing processes	<p>N/A</p> <p>The process of tariff revision is political and does not have a single methodology for calculating, confirming, and adjusting tariffs.</p>
A single tariff for all types of cargo. Providing benefits and discounts exclusively within the limits of the economic effect	Ensuring equal rights of all consumers of railway transport services	<p>N/A</p> <p>Differentiated payment system depending on the type of cargo (three tariff classes).</p> <p>There is no economic justification for such a model.</p>
Possibility of market access by private business	Creation of prerequisites for competition, which contributes to improving the quality of services	<p>N/A</p> <p>The Cabinet of Ministers decided to experiment with the admission of private traction, but its implementation was not successful, according to the report of the Ministry of Infrastructure.</p>
Distribution of business verticals (locomotives, cargo and passenger transportation, regional transportation, high-speed traffic, etc.)	Preventing cross-financing of expenditures of some areas of transportation at the expense of others. Separation of subsidized regional transportation.	<p>N/A</p> <p>The action plan to reform railway transport provided for the beginning of the process of distribution of business verticals during 2020–2022, but its implementation was canceled.</p>
Creation of a national regulator in the field of railway transport	Control of all market participants, regardless of the form of ownership. A prerequisite for creating a competitive market.	<p>N/A</p> <p>The action plan to reform railway transport provided for the creation of such a body and was laid down in the draft law 1196–1, which the Verkhovna Rada did not support.</p>

1.3 Corruption risks

An important challenge in the field of railway transport is the high level of corruption risks that affect most operational processes – from the state-owned company’s procurement costs to the provision of services and the use of the company’s property.

Corruption abuses in Ukrzaliznytsia have led to [dozens of investigations](#) by the National Anti-Corruption Bureau of Ukraine (NABU), with losses amounting to billions of hryvnias.

According to the NABU, in 2019–2020 alone, Ukrzaliznytsia [lost UAH 17 bln \(USD 600 mln\)](#) due to abuse in setting unjustified freight tariffs.

During the audit of the activities of Ukrzaliznytsia for 2017–2020, the State Audit Service identified [violations and risks worth UAH 61 bln \(more than USD 2 bln\)](#).

Some corruption abuses relate to investment projects. During the construction of the Boryspil Express, the NABU [investigated the overpayment](#) for the procurement of electronic services as part of the project for UAH 10.7 mln. Five persons involved were served with charges. The company’s management was also accused of [illegally concluding contracts](#) for the repair of rail buses in the amount of UAH 49 mln.

Corruption risks are associated with a high role of managerial decisions and non-transparency of processes within the company. They are exacerbated, among other things, by the lack of a competitive and open management selection process.

The management of Ukrzaliznytsia was repeatedly [accused](#) of abuse and decision-making contrary to the interests of the company.

In particular, one of the previous heads of the board [was dismissed after a scandal](#) with the conclusion of a contract for the lease of freight cars of Ukrzaliznytsia to a private company at prices two times lower than market prices.

In recent years, Ukrzaliznytsia has formally [introduced](#) risk management structures and established a compliance office. However, due to non-transparent competitions to establish these bodies, it is difficult to assess the quality of their work.

The company needs a quality review of the strategy for selecting, appointing, and evaluating the effectiveness of management personnel associated with increased corruption risks. There is a demand for the introduction of open competitions with measurable and clear criteria for evaluating candidates. It is necessary to establish objective key performance indicators (KPIs) for the management staff, as well as effective structures to counter internal risks that will be administratively independent of the management of the company.

It is also necessary to introduce tools to minimize the subjective impact when interacting with users of services and assessing the quality of service based on customer feedback.

1.4 Railway legislation and reform challenges

Key regulatory acts in the field of railways:

- Law of Ukraine [On Rail Transport](#)

- Law of Ukraine [On Features of Establishment of Joint-Stock Company of Public Railway Transport](#)
- Resolution of the Cabinet of Ministers of Ukraine No. 735 dated September 2, 2015. [On Approval of the Charter of JSC Ukrainian Railways](#)
- [National Transport Strategy of Ukraine](#)
- [Railway Reform Action Plan](#)

The Association Agreement between Ukraine and the EU defines [commitments regarding the implementation](#) of seven directives and four regulations of the European Union in the field of railway transport.

In 2019, the Government of Ukraine approved the [Railway Reform Action Plan](#) (hereinafter referred to as the Plan), which contained a list of steps necessary to bring the rail transport market in line with the requirements of EU legislation.

In particular, the Plan provided for the creation of a rail transportation market, a change in the principles of state regulation, and the division of JSC Ukrzaliznytsia into individual operators in the areas of railway services.

Some provisions of the Plan may be debatable, but the general vector of the proposed changes coincides with the vector of adaptation of the Ukrainian railway market to the requirements of EU directives and the implementation of the Association Agreement.

The implementation of the Plan began in 2019–2020, but soon the process was suspended. In particular, the Supervisory Board of Ukrzaliznytsia suspended [the decision to establish operators](#) in the field of freight transportation and in the field of infrastructure (UZ Cargo and UZ Infra).

Such a decision could be the result of [a conflict](#) between the management bodies and the Supervisory Board of the company, which subsequently led to an investigation by a parliamentary group of the situation around Ukrzaliznytsia. In practice, the multi-month investigation process [ended](#) only with separate personnel decisions and did not lead to systemic changes.

At the same time, the implementation of the Plan and the reform of railway transportation in Ukraine were postponed.

Railway transport reforms were also laid down in the draft law [No. 1196–1](#) On Railway Transport of Ukraine, dated September 26, 2019. The document was supposed to identify new mechanisms in the railway services market but was never considered by the Verkhovna Rada of Ukraine. It has been under review for over three years.

The National Council for the Recovery in its [draft proposals](#) for measures to rebuild the transport infrastructure for the period of hostilities notes that before the end of the war and in the next two years, it is inappropriate to carry out railway transport reforms.

However, this statement is questionable, since rail transport requires complex changes, in particular at the legislative level. The implementation of reforms takes time, so it is advisable to implement them at the stage of preparation for reconstruction.

In particular, during the war it is possible and appropriate to:

- complete the legislative reform of railway transport, which will be put into effect after the end of hostilities;

- divide JSC Ukrainian Railways into individual service operators in accordance with the requirements of EU directives and standards;
- create an independent regulatory body and a licensing body for railway transport;
- introduce mechanisms for transparent tariff setting, etc.

Let us note that the previous strategy of the state, which provided for the imposition of the obligation to reform the railway on Ukrzaliznytsia JSC, is ineffective. The withdrawal of the government from the division of the company into railway service operators led to the failure of this process and conflicts within the company.

1.5 The role of the railway during the war

Rail transport plays an important role after the beginning of the full-scale invasion of Russia on the territory of Ukraine on February 24, 2022. In the first months of the full-scale war, about 4 mln citizens were evacuated from high-risk areas by rail. In particular, more than 600,000 citizens left Kharkiv for safer zones.

Rail transport remains the best one for the rapid evacuation of large numbers of people from dangerous areas.

On average, one train can evacuate several thousand people, and in general, rail transport can provide rapid movement of tens of thousands of people every day. For road transport, such volumes would mean a significant risk of collapse, congestion and, as a result, even higher risks for the population.

Today, railway remains a reliable mode of transport in conditions of danger. At the same time, railway infrastructure is one of the military goals of Russia, which is trying to destroy internal logistics and complicate the supply of military and humanitarian aid from Western countries.

According to an independent damage assessment by KSE as of November 2022, in the temporarily occupied territories, the enemy seized or destroyed railway infrastructure worth about USD 4.4 bln.

Until the end of hostilities, the railway will play an important role in meeting the needs of the population for transportation within the country and abroad. In 2022, one and a half million passengers left by rail towards EU countries.

The main tasks of railway transport during the war:

- support of passenger and cargo transportation functional capabilities;
- evacuation of residents from high-risk areas;
- improving the safety of passengers at stations and railway stations;
- ensuring throughput capacity in the direction of European Union railways (for freight transportation).

CHAPTER 2. GLOBAL EXPERIENCE IN RECONSTRUCTION AND INTEGRATION OF RAILWAYS

2.1 Integration into a single transport network of EU countries with non-standard gauge

Usually, the 1,435 mm gauge standard is called the European Gauge, but in fact, not even all EU countries meet it. In particular, Spain, Portugal, Finland, and the Baltic countries have another gauge standard.

For example, for Spain and Portugal, the main type is a wide gauge of 1,668 mm.

More than 11,800 km of Spanish tracks have such width, while the length of the European gauge is only 2,300 km, or 15% of the country's railway infrastructure.

Spain has only partially integrated the EU standard, mainly for high-speed rail traffic. The 1,435 mm tracks were built in parallel with the already existing 1,668 mm network, which is used for other types of transportation.

The rest of the country's railway infrastructure is not integrated into the general network. However, it should be noted that the number of trans-European transport corridors in the country, in particular with neighboring France, is very limited, and rail transport on the Iberian Peninsula is mainly domestic.



The experience of countries such as Spain and Portugal is usually cited as an argument for preserving the 1,520 mm gauge in Ukraine. However, this argument is mistaken for several reasons.

The isolated nature of Spanish and Portuguese railways has led to a significant reduction in their role. The total freight turnover of the railways of Spain is [8–10 mln tkm](#) per year, which is twenty times less than for the railways of Ukraine. This strengthens the role of road transport, increases the load on highways, and therefore increases atmospheric emissions per unit of transport work.

In addition, the European Union [pays great attention](#) to the creation of a unified transport network. In particular, it plans to transfer all railway tracks to a single standard of 1,435 mm, and the strategy of the common European railway network is [included in the list of five main tasks](#) of the EU Agency for Railways.

It is likely that countries with non-standard track widths will be able to retain them for transportation of secondary and regional significance. At the same time, the main railway lines must comply with the general infrastructure standard, including the gauge of 1,435 mm.

Ukraine will not be able to preserve the role of rail transport without integration into the EU transport system.

The Technical Advisory Service of the European Investment Bank (EIB) [has launched a pre-feasibility study for the development](#) of 1,435 mm gauge cross-border connections to link the railway networks of Ukraine and Moldova with the trans-European transport network due to Russia's full-scale attack on Ukraine.

The EIB notes the importance of integrating Ukraine's railways into the EU network. It can have a significant economic impact on the country and the development of investment in the future.

2.2 Germany: experience of railway revival

Germany, divided after World War II into two separate countries, [reunited on October 3, 1990](#). For rail infrastructure, this marked the beginning of the arduous path of connecting two networks – Deutsche Bundesbahn (FRG) and Deutsche Reichsbahn (GDR) – with different rolling stock and systems. To physically connect the countries, new lines and stations were built, and to transform the level of services, new trains were launched. The German railway started reforms in [1994 with EUR 8 bln in losses per year](#). Today, the German rail market is one of the most dynamic in the world. It is open, competitive, with clear transparent procedures and wide application of private capital. More than 300 railway operators are engaged in this market, and more than 100 concession agreements have been concluded in passenger traffic.

At the first stage of the reform, Germany set goals to increase the share of the railway services market and reduce the burden on the federal budget in the long term, since at the end of 1993, the total debt of railways was [EUR 34 bln](#).

The transformation into a joint-stock company Deutsche Bahn AG with minimal state influence was a vital step towards German railway reforms. This limited the influence of the country's government on the corporate governance of the company. The joint-stock company had four subsidiaries:

- DB Regio AG – for local and regional passenger transportation;
- DB Reise und Touristik AG – for intercity passenger transportation;

- DB Cargo AG – freight transport;
- DB Netz AG – railway infrastructure.

Subsequently, a fifth structure – DB Station+Service AG – for passenger railway stations and service was created.

Further steps to reform the industry were:

1) Debt relief.

Creation of a special body of the federal government – Bundeseisenbahnvermögen ([BEV](#)), responsible for asset management. It received the financial burden of EUR 34 bln inherited from the Bundesbahn and the Reichsbahn, as well as the issues of staff and pension payments. From 1994 to 2002, the German government spent between EUR 16 bln and EUR 19 bln annually – an amount that included interest rates and debt repayments.

2) Regionalization of passenger transportation.

Creation of [DB Regio](#). Decentralization has become a pillar of the railway reform. Since 1996, the government has been providing financing to the federal states; they, in turn, organize regional passenger transport on a buyer/supplier basis. This gave impetus to create an attractive market segment with competitive tenders. Subsidies for regional transport were the price the national government had to pay to convince the federal states of the 1994 reform. But for these subsidies, which amounted to approximately EUR 7 bln per year, regional transportation would probably have been reduced, as ticket sales cover only about a third of their costs.

3) Liberalization of the transportation market.

DB Netz AG, the infrastructure operator, was unprofitable. To improve the situation, the state implemented a set of measures, one of which was the introduction of an open access regime in the rail freight market and in long-distance passenger traffic. Because the railroad has sovereign functions (responsibility for services of general interest), operator access and rolling stock approval remained with the federal government. The market was opened to increase transportation by this mode of transport. At the same time, the state charged market operators for the use of infrastructure.

4) Reducing redundant infrastructure.

The length of the railway network after commercialization [decreased](#) to 34,000 km in 2021, while in 1994, it was 41,300 km.

Electrification of tracks instead increased by 16% to reduce operational costs and improve environmental performance.

Between 1994 and 2017, transport performance on federal railways increased by more than 40% for passenger transport and more than 80% for freight transport. As a result, the railway retained and expanded its position in the transport services market.

The cost of maintaining the railway has decreased by a third since 1994, and, most importantly, there has been a transition from consumer spending to investment.

The example of German railways shows the role of strategic planning. One of the decisive factors for success is the systematic implementation of reforms, since each individual event could not give the desired result.

For Ukraine, the experience of German railways is important because it has similar problems: over-staffing, redundant infrastructure, and lack of access of private capital to the market.

2.3 UK: from collapse to Europe's safest railway

The railways of Great Britain are a vivid example of the fact that railway transport reform must be approached as carefully and responsibly as possible.

Britain's railways reform program in the early 1990s envisaged global privatization and the minimization of the role of the state. Therefore, in 1994, the private company Railtrack became the operator of the country's railway infrastructure.

However, the government did not provide the necessary level of control over the targeted use of funds and the implementation of minimum expenditures to maintain the technical condition of the infrastructure by the private operator.

In order to maximize profits, artificially overstate financial indicators, and pay excessive dividends to the company's shareholders, Railtrack systematically underfinanced the needs of the railway infrastructure. The deterioration of the railway infrastructure eventually led to a number of accidents on the railways.

From 1996 to 1999, 38 people died and more than 600 were injured in accidents on the Western Main Line. The tragedy near [Hatfield](#) in autumn 2000 served as a trigger for a change in the approach to public administration.

The investigation found that a number of reasons served as the cause of death of 4 and injury of 70 passengers:

- insufficient level of qualification of staff;
- violation of the track maintenance mode;
- rail defects.

During the investigation of the accident, it was found that these violations were of a systemic nature and led to a general deterioration in the technical condition of the railway infrastructure. During the year, the state introduced more than 1,800 speed limits, launched a nationwide track replacement program worth GBP 580 mln. All railway operators lost approximately 19% of their revenue during the year following the accident. The EWS freight operator cancelled up to 400 trains each week. Losses of another freight operator – Freightliner – amounted to GBP 1 mln per month. The cost of transport disruptions in the year following the disaster was GBP 6 mln per day.

The Railtrack Board requested [GBP 3.5 bln](#) in state aid on 24 November 2001 to prevent the collapse of Britain's railway infrastructure. In the same year, the company [paid dividends](#) to its shareholders in the amount of GBP 137 mln.

Great Britain was forced to take emergency measures and return the railway infrastructure to state ownership.

The state created a national infrastructure operator Network Rail Ltd. After reforming the company's management model and monitoring the technical condition of the railways, the British railway was [repeatedly recognized](#) as the safest in Europe.

The functions of control of the infrastructure operator were entrusted to the Office of Rail and Road of Great Britain (ORR). The body monitors the implementation of Network Rail goals set in accordance with the obligations in the network license and forecasts in the company's own business plan. In the event of poor performance, the company will be criticized, and commercial customers and the ORR may resort to coercive actions against it under their contracts.

For objective control, ORR introduced [Public Performance Measurement](#) (PPM) for railway infrastructure. The Office carries out annual monitoring of the compliance of the actual indicators of Network Rail with the planned PPM. The ORR also introduced financial control measures.

The experience of the railways of Great Britain speaks of the importance of preserving the function of the state as an independent controller of the quality of services and traffic safety. Since the commercial management model provides for the primary profit for investors, private operators may not be sufficiently motivated to allocate funds primarily to maintain the proper condition of the railway infrastructure.

Britain is one of the few countries that initially allowed the privatization of railway infrastructure but was forced to abandon this model. Unlike other areas of business, privatization in the field of railway infrastructure contains excessive risks, and therefore is inappropriate. After all, the maintenance of railway infrastructure implies the primary responsibility for traffic safety, which is more important than the profitability of the business. Therefore, this function does not fully correspond to the commercial management model.

It is important not only to maintain control over the state of the railway infrastructure in the area of responsibility of the country, but also to introduce clear processes for impartial monitoring and assessment of the technical condition of railways, including effective control over the targeted use of revenues and investment programs.

2.4 United States: the social role of passenger rail transportation

The United States is one of the countries with the most developed domestic air passenger transportation. The prerequisite for this is the size of the country: the area of the United States is twice the area of all EU countries.

Over long distances, the railroad loses competition to air travel. The cost of a railway ticket at a distance of more than 1,000 km may be equal to or even higher than the cost of an aviation ticket. After all, the construction of railway infrastructure requires higher costs if the distances between the end stations are significant.

The cost of aviation infrastructure does not actually depend on the distance between airports, so the transportation is influenced only by the cost of the fuel consumed and the resource of the vehicle.

Despite this, the United States retains and supports the role of railway infrastructure in view of its social and security function.

Air transport is the least reliable in crisis situations and natural disasters. In particular, during Hurricane Irma in 2017, airlines [canceled more than 4,000 flights](#).

The only modes of transport that are suitable for rapid evacuation from a potential danger zone are buses and trains. But the problem for bus transport can be congestion of highways due to excessive traffic. Instead, railway transport, which is capable of evacuating tens of thousands of citizens per day, does not depend on traffic and weather.

In response to the risk of the disappearance of rail passenger transportation, the United States founded the national passenger railway company Amtrak in 1971. In fact, by creating it, the state tried to preserve the role of passenger rail transportation, which was inferior in competition to air transportation.

Critics of Amtrak talk about the company's non-profitability and that it mostly consumes taxpayer funds, rather than generating profits. However, it retains the social and security function of rail passenger transportation.

In 2021, Amtrak [carried](#) only 12.2 million passengers – almost 7 times less than Ukrzaliznytsia. At the same time, the average [cost of passenger-kilometer](#) for Amtrak is 2.5 times higher than the cost of transportation by air.

Despite the insignificant role in domestic transportation and the higher cost relative to air travel, Amtrak remains in the passenger transportation market precisely as a company that is a reliable alternative to air transportation in crisis situations.

The loss of rail passenger service could have significantly worse consequences for the U.S. than the costs borne by the federal budget to maintain Amtrak.

For Ukraine, this experience speaks of the need to maintain a balance between the commercialization of the railway services market and the satisfaction of public and security needs. In particular, for Ukraine, domestic passenger air transportation will not be able to fully replace railway traffic. In addition, competition between different modes of transport should consider the security and social functions of the state.

2.5 Egypt: modern experience in attracting investment in the modernization of railways in North Africa

The Egyptian railway had large-scale problems with traffic safety and quality of services in the early 2000s. The prerequisite for the reforms was a large number of accidents. In particular, the El Ayyat disaster in 2002 was one of the largest railway accidents in terms of the number of victims – it killed [more than 373 people](#).

Following this accident, the national railway company ENR launched [a program to upgrade](#) equipment and improve safety.

However, the reform process got stalled. Privatization concerned only some ENR services, and after [the accident in Qalyub in 2006](#), general criticism and accusations of corruption only intensified.

Since 2009, Egyptian railways [have launched a program](#) to attract private capital to modernize the railway infrastructure.

In 2014, the Egyptian National Railway announced [a decade-long investment](#) of USD 10 bln to modernize its network, and the country has continued this practice ever since.

The country also developed [Egypt's Transport Policy for 2014–2021](#), which provided for clear steps to develop the railway transport network and improve safety.

According to the 2021 GlobalData report [Railway Construction Projects, Middle East](#), investments in Egyptian railway projects amount to approximately USD 50 bln. This suggests that the country's government has managed to gain the trust of international funds.

In particular, the Ministry of Transport of Egypt [signed a memorandum](#) of understanding with Siemens Mobility, which provides for the development of the country's first electric high-speed railway worth more than USD 3 bln.

This agreement is only the first part of a USD 23 bln project to build a 1,000-kilometer rail network.

The World Bank [approved a USD 440 mln loan](#) to rebuild ENR's traffic safety systems. In particular, funds are provided for the modernization of alarm systems on the routes Alexandria – Cairo and Beni Suef – Nag Hammadi.

Large-scale investments allowed increasing rail transportation in Egypt. According to a [World Bank report](#), approximately 270 mln passengers used ENR trains in fiscal year 2019, compared to 228 mln in fiscal year 2015.

Attracting external financing also contributed to the demonopolization of ENR in the railway services market. In 2022, Deutsche Bahn International Operations [was selected](#) to provide maintenance services for the Suez Canal on Rails high-speed railway line for a period of 15 years.

This year, the Egyptian government [has approved a number of other projects](#) at the expense of world banks.

Total investment in Egypt's railway infrastructure is estimated at USD 100 bln over 20 years. However, the total length of the country's railways is only about 5,000 km, which is four times less than in Ukraine.

The prerequisites for such a large-scale cooperation were a clear strategy of modernization on the part of the government and readiness for systemic transformations in the railway services market.

Investments in railway infrastructure caused a rapid [increase in demand](#) for its services and increased public confidence.

Post-war Ukraine can become a European leader in attracting investment in rail transport. To do this, the government must ensure that an effective reconstruction strategy is developed, and that measures are identified that meet investors' expectations. In addition, to ensure the trust of partners, these measures need to be implemented.

2.6 China: experience of large-scale investments in high-speed lines

In the early 90s, the railway in China was poorly developed, and the average speed of trains was only 48 km/h. Today, China has the world's largest network of high-speed rail lines.

By 2004, China had implemented projects to improve infrastructure and increase the maximum train speed to 160 km/h. In fact, this corresponds to the level of development of the Ukrainian railway network today.

In 2004, the government made a strategic decision to divide traffic in China into passenger and freight and also provided high-speed traffic lines (300–350 km/h).

China [benefited from the experience](#) of leading countries that have also provided access to technology. Given the prospects of the Chinese market, Alstom, Siemens, Bombardier Transportation and a Japanese consortium led by Kawasaki volunteered to help with technology.

Total investment in new rail lines rose to USD 22.7 and USD 22.6 bln in 2006 and 2007, respectively, from USD 14 bln in 2004.

By the end of 2020, China National Railway used more than 9,600 high-speed trains daily, including the world's only high-speed night sleeper services on certain long-distance routes.

The unmanned ["bullet trains"](#) connecting Beijing and Zhangjiakou in northern Hebei province are capable of speeds of up to 350 km/h, making them the fastest autonomous trains in the world.

The World Bank, in a 2019 [study](#), estimated the economic impact of China's high-speed rail network at 8%. This far exceeds the opportunity cost of capital in China for large long-term infrastructure investments.

Investing in high-speed transport has many benefits: reduced travel time, increased safety, and better conditions for tourism, workforce, and mobility. Rail transportation also reduces highway congestion, accidents, and greenhouse gas emissions.

In its [study](#), the Paulson Institute estimated that the net benefit of high-speed rail to the Chinese economy is approximately USD 378 bln, and the annual return on investment is 6.5%.

The experience of China proves the feasibility of private investment in high-speed rail traffic due to higher real return compared to other types of passenger rail transportation.

In post-war Ukraine, high-speed traffic is likely to become the main focus of public-private partnerships in the field of railway transportation.

2.7 Japan: high-risk challenges and solutions

For Japan, which is in a zone of increased seismological danger, the problem of railway transport safety is one of the key ones.

Rapid post-war restoration and modernization of railways without appropriate safety measures led to [a number of accidents](#) in 1956–1963. Their main reasons were an increase in the intensity and speed of trains, while the traffic safety system remained oriented on previous conditions.

In the 1960s, Japan revised its strategy for organizing rail transportation and began to reform the traffic safety system.

An [automatic train control \(ATC\)](#) system has been introduced on railway lines, which monitors any violations (including speeding) and activates the emergency brake system. In addition, a system

of notification of seismic activity and automatic stopping of train traffic in case of danger was introduced.

Japan's latest high-speed train class, the N700S, has a new braking system capable of quickly stopping a train. It additionally provides for the possibility of backup power supply from rechargeable batteries if the power supply systems are damaged. This allows the train to leave the danger zone in autonomous mode.

Such measures allowed the country to achieve a unique success – to become a world leader in speed and traffic safety, being in an area of increased seismic activity.

The experience of Japan is important for post-war Ukraine, which will also have to develop its own solutions to achieve a high level of safety in rail transport, especially in the field of fast and with the prospect of high-speed transportation. Security measures include restricting third-party access to high-speed lines, introducing surveillance systems for sensitive elements of the railway infrastructure, notification and emergency power. In addition, the requirements for stations in terms of inclusiveness, as well as issues of passenger safety in the event of air attacks, need to be reviewed.

The railway safety strategy should be developed simultaneously with the strategy of modernization and integration of the Ukrainian railway into the EU network. Security measures should be compatible with the threats Ukraine has faced.

CHAPTER 3. STEPS TO RECONSTRUCT RAILWAY IN UKRAINE

The railway network of Ukraine was built in accordance with the realities of the Russian Empire and the USSR with the center in Moscow, so it does not meet modern needs for the most part. Consequently, the Ukrainian government should focus not only on the physical reconstruction of the destroyed infrastructure, but also on the modernization of railway transport in accordance with the new conditions.

First of all, the government should comprehensively assess the model of development of the country's economy, the role and prospects of railway transport in the post-war realities. The railway operator, like the railway market in general, needs reforms. The role of the state in the field of railway transport should also change.

The government should determine the future main directions of external and internal routes, find the optimal model of passenger and freight transportation, preserve the role of the railway in the market, and move towards reducing carbon footprint in transportation.

Next, we will look at the key areas that should be considered when restoring the railway in Ukraine.

3.1 Reforming the legislation on railway transport

The government should resume the reform of the railway, first of all – to modernize the legislation on railway transport. The Verkhovna Rada should finalize draft law [No.1196-1](#) On Railway Transport of Ukraine or develop a new document that will determine the key principles of organization and models of the railway transport market in post-war Ukraine. The modernization of the legislation is also the first step towards the start of the integration of the railway infrastructure into the EU transport network.

Certain provisions of the [Railway Reform Action Plan](#) need to be substantially revised. One of the possible drawbacks of the existing Plan is the lack of division of passenger transportation into intercity, regional, and high-speed. This is important because the role and principles of these modes of transport differ significantly. In particular, regional transportation is distinguished by a social function, dependence on regional authorities, and a high dependence on subsidies. Instead, high-speed transportation requires a completely different strategy and priorities, so in most EU countries it is carried out by a separate railway operator.

The experience of Germany, which has developed regional transportation perhaps the best among all EU countries, can be useful for Ukraine. In German regional transport, the cooperation of the railway operator and the regional authorities plays a leading role, since they are the main customer of services. At the same time, the central government determines the feasibility and methods of compensation (subsidies) for unprofitable railway transportation, if it cannot be replaced by other modes of transport or such replacement will have significant negative consequences, such as increased traffic, environmental degradation, etc.

In Ukraine, according to the Railway Reform Action Plan and Draft Law No.1196, these functions are planned to be entrusted mainly to the government and a single railway operator. However, this

approach will lead to negative consequences, in particular:

- neglecting the real needs of communities and regions in determining the feasibility of regional transportation;
- lack of incentives for communities to support and modernize regional transportation;
- cross-subsidization of other modes of transport, which will lead to underfunding of their own needs;
- unprofitability of regional transportation, which will hamper the overall development of passenger transportation.

All these problems are already systemic for regional passenger transportation in Ukraine.

High-speed transportation is usually profitable, but it needs a long-term strategy because of the much higher initial investment in infrastructure construction and rolling stock acquisition.

The cost of building high-speed lines is usually twice or even five times higher than the cost of standard tracks for speeds up to 160 km/h. The cost of high-speed trains is one and a half to three times higher than the cost of conventional trains with the same passenger capacity.

The existing Action Plan for the reform of railway transport did not define the role of high-speed transport and did not provide for the creation of prerequisites for their organization in Ukraine, due to the lack of lines with a speed of more than 160 km/h.

At the same time, [the draft proposals](#) of the National Council for the Recovery envisage the creation of at least one high-speed line route Kyiv-Warsaw. Its preliminary cost is EUR 1.2 bln, and it is the first one to introduce high-speed rail traffic in Ukraine.

Therefore, it is advisable for the government to reassess and adjust the strategy for the development of railway transport in accordance with modern requirements and needs, in particular in the field of passenger transportation.

3.2 Integration of Ukrainian railways into the trans-European transport network (TEN-T)

In Ukraine, it is widely believed that integration into the EU is possible without changing the standard of railway gauge because this process is complex and requires significant investment. However, recent decisions of the EU bodies in the field of railway transport indicate that the transition to the 1,435 gauge is mandatory for all participating countries in the medium term (by 2050). Therefore, for accession to the EU, Ukraine must be ready for a global restructuring of the railway network.

Among other requirements for the unified transport network, the EU [defines](#):

- ensuring a minimum speed limit of 160 km/h for passenger traffic on the main and extended support networks, and 100 km/h for freight traffic;
- first and last mile connections via multimodal passenger hubs in all EU cities that are connected to the network and have a population of more than 100,000 inhabitants;
- enhancing air-rail links for all EU airports in the network and those serving more than 4 mln passengers; facilitating air-rail multimodal travel on such routes;
- the maximum waiting time at the border for freight trains is fifteen minutes;
- the possibility of transporting trucks by network trains;
- increased resistance to natural and man-made disasters;

- підвищена стійкість до природних і антропогенних катастроф;
- introduction of a unified train control system (ETCS), in particular alarm and speed control (ERTMS), as well as a communication system (GSM-R).

The experience of Spain, Portugal, and the Baltic States proves that the functioning of internal railway networks of a distinctive gauge leads to the isolation of the railway and the reduction of its role. This is undesirable for Ukraine, as it will lead to an excessive load on highways.

Now, western cross-border railway crossings provide [only 50%](#) of the needs for transport work for export-import transportation.

The general EU strategy in the field of railway transport suggests that the European Union is unlikely to support the idea of building transshipment terminals on the border with Ukraine as the main strategy for integrating the Ukrainian railway into the EU transport network in case of Ukraine's accession to the EU.

In 2022, the European Commission [amended](#) the plans for the development of TEN-T trans-European networks and added Ukrainian railways to them.

Consequently, Ukraine will be able to switch to 1,435 mm tracks by 2040-2050 in various ways. It will be able to build an alternative railway network on the main transport routes with the gradual decommissioning of 1,520 mm wide tracks or replace the infrastructure in stages. However, a long-term strategy must necessarily include the transition to a single European gauge standard.

3.3 Transformation of JSC Ukrzaliznytsia and counteraction to corruption risks

The government should complete the distribution of functions of Ukrzaliznytsia and create a national infrastructure operator that will be responsible for the targeted use of revenues from services and investment programs. Such steps will become a prerequisite for further railway reform, improvement of management and control over the use of revenues.

It is also necessary to minimize cross-subsidization of the railway at the expense of other modes of transport, which for many years has led to systematic failures of investment programs and disruption of infrastructure modernization.

One of the most important tasks is to overcome corruption. To achieve it, it is necessary to revise a number of processes and procedures within Ukrzaliznytsia, in particular: approval and regulation of tariffs; personnel selection and assessment of the management of the company or its divisions; assessment of the efficiency of the use of railway revenues; assessment of the quality of infrastructure; system of counteracting internal risks. At the same time, all stages of renewal and transformation of Ukrzaliznytsia should be open and transparent.

3.4 Rail transportation market reform

An integral part of the strategy for preserving the share of rail transport in the transportation market in Ukraine should be its adaptation to new conditions. The authorities should introduce legislative and institutional changes that will ensure equal access of all market participants to railway services, development of competition, and proper traffic safety control.

The deterioration of the rolling stock of the state monopolist Ukrzaliznytsia has already reached a critical level. In addition, monopolies are usually less adaptive and less responsive to changes and new market challenges. Because of this, transportation services lose their relevance, variability, and adaptability, and eventually, their role in the transport system.

Attracting private companies to the locomotive traction market will accelerate its modernization. The use of private traction will reduce the downtime of cars and speed up the execution of transportation requests, and the competitive market will minimize the role of the state, which is currently excessive.

In addition, Ukraine supported the course of reforms for integration into the EU and agreed to adapt its processes to European standards. The prerequisite for such integration is the creation of independent institutions for regulation and licensing in railway transport. These institutions should also ensure the proper quality of traffic safety monitoring and control in order to avoid the problems other countries face during the liberalization of the rail transport market.

3.5 High-speed rail passenger transportation

High-speed railway traffic is the main potential direction for the development of high-quality passenger transportation in Ukraine, considering its economic and geographical indicators. For EU countries with similar territorial and demographic characteristics to Ukraine, such as France, Germany, or Spain, this type of rail transport is also key.

Domestic air transportation has a significant advantage for countries with key transport routes longer than 1,000 km (as in the USA). However, in Ukraine, most transport routes do not reach such distance, so air transportation here will not be an alternative to high-speed rail traffic.

Other advantages of high-speed rail transportation compared to air transportation are the lower ticket price with an average travel time of up to five hours at distances of up to 1,000 km, as well as better accessibility of railway stations for residents of cities (since airports are located mainly remote from settlements). In addition, rail transport is safer, more eco-friendly, and more punctual.

Since high-speed lines must be separated from the public lines used by freight trains, they can be built according to the European standard of 1,435 mm gauge.

However, this type of railway traffic requires higher capital investments. To organize it in Ukraine, it is necessary to build about 3,000 km of appropriate tracks. The average cost of such construction will be approximately USD 5–30 mln/km. In addition, it is necessary to purchase high-speed electric trains at a cost of approximately USD 25–30 mln per unit.

CONCLUSIONS

Analysis of the current technical, investment, and regulatory state of railway transport in Ukraine indicates the need to develop a strategy for reforming this area as soon as possible. The constant postponement of reforms led to the accumulation of systemic problems that had not been resolved before the beginning of the full-scale Russian invasion of Ukraine.

The effectiveness of the restoration of Ukrzaliznytsia and the role of rail transportation in post-war Ukraine depends on the timely development and implementation of a number of steps, in particular:

- updating the legislation on railway transport;
- integration of Ukrainian railways into the trans-European transport network;
- transformation of JSC Ukrzaliznytsia and reduction of corruption risks in the company;
- reform of the railway transportation market, in particular, the development of competition in the services of operators of such transportation and locomotive traction services;
- introduction of high-speed passenger transportation.

The Government of Ukraine should resolve the issue of the role of rail transport in freight and passenger transportation; integration of the Ukrainian railway into the EU transport network; harmonization of regulatory policy with EU legislation; combating corruption, etc.

The authorities should prepare a comprehensive plan for the restoration and development of railway transport for its rapid restoration. The development of such a document should not be postponed until the end of the war. A part of the reforms needs to be implemented in preparation for a full-fledged post-war reconstruction of the railway, which will allow us to start implementing recovery programs without delay and will help quickly overcome the crisis in the field of railway transportation.

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