

## DEVELOPMENT OF TRANSPORT INFRASTRUCTURE IN UKRAINE

A. Buryachenko, N. Konashchuk

Kiev National Economic University named after Vadym Hetman

Prospect Peremogy, 54/1, Kyiv, 03680, Ukraine E-mail: andrii.buriachenko@kneu.ua

**Purpose.** The essence and importance of transport infrastructure in the state economy are investigated in the article.  
**Methodology.** The current state of the Ukrainian transport infrastructure is analysed in terms of passenger and cargo transportations according to different transport types, length and density of transport lines.

**Originality.** The article specifies the strategic prospects for development and possible ways to improve the effectiveness of the existing transport infrastructure. Special attention is paid to existing problems and barriers in the way of transport infrastructure development.

**Practical value.** Some suggestions concerning resolving the existing problems are provided and use of the transport branch potential in Ukraine using foreign experience. References 12, tables 3.

**Key words:** transport infrastructure, cargo transportations, passenger transportations

## РОЗВИТОК ТРАНСПОРТНОЇ ІНФРАСТРУКТУРИ УКРАЇНИ

А. Е. Буряченко, Н. Е. Конащук

ДВНЗ «Київський національний університет ім. Вадима Гетьмана»

проспект Перемоги, 54/1, м. Київ, 02000, Україна E-mail: andrii.buriachenko@kneu.ua

У статті досліджено сутність та значення транспортної інфраструктури у економіці держави. Проаналізовано сучасний стан транспортної інфраструктури України у розрізі пасажирських та вантажних перевезень за різними видами транспорту, довжини і щільності транспортних шляхів. Вказано стратегічні перспективи її розвитку та можливі шляхи підвищення її ефективності. Значну увагу приділено існуючим проблемам та перешкодам розвитку транспортної інфраструктури. Надано пропозиції щодо вирішення наявних проблем та використання потенціалу транспортної галузі України на основі зарубіжного досвіду.

**Ключові слова:** транспортна інфраструктура, вантажні перевезення, пасажирські перевезення.

**PROBLEM STATEMENT.** After proclamation of European integration as a strategic vector of Ukraine orientation one of the most important tasks was to ensure the effective functioning of the transport infrastructure. The modern transport system in Ukraine stands in need of considerable investments to construct new transport connections and modernize the existing ones, to form the latest fleet of vehicles and to improve the system vehicles management.

The transport system occupies one of the top opportunities among the elements of economic potential; moreover its role is increasing unceasingly. Proper functioning of the country's economy depends on the condition of the transport infrastructure as it combines all industrial branches into the sole complex. The transport has also an important meaning for optimal location and development of efficient forces of the country, reasonable usage of the existing resources, and also assists in consolidation of international economic relations. Except economic tasks transport system resolves social problems such as meeting travelling requirements, providing goods in necessary quantity and variety, eliminating essential social and economic and cultural differences between administrative-territorial state units.

The objective of the article is to determine the meaning of transport infrastructure within the economic development of the country, to analyze the modern conditions in functioning of Ukraine transport system and to give proofs of the suggestion concerning the solution to current problems and usage of the transport branch potential.

**EXPERIMENTAL PART AND RESULTS OBTAINED.** To define what infrastructure means and its connection to the other economic branches:

transport, communications, education, and health care. Infrastructure plays a key part in the modern economy, on one hand it stimulates economic development, and on the other it is determined by government policy and the direction of economic modernization.

Transport infrastructure has a strategic feature and it's one of the main indexes of competitive ability, civilization and development of the state. The role of the transport system lies not only in transportation of cargoes and passengers. The transport branch influences the whole process of extended reproduction; as a result it stimulates economic and social development.

The concept of reforming the transport sphere of economy provides the definition of the transport infrastructure as aggregate of constructions, the system of net connections between all transport types, which meet the requirements of the population and industries in transportation of passengers and cargoes [1].

O. Pikulyk points out that transport infrastructure is aggregate of transportation links, objects for servicing passengers and cargo transportations, objects maintenance and repairs, which secure conditions for providing transport service, that is movement of cargoes and passengers [2].

N. Tkachenko suggests to consider transport infrastructure as an element of common infrastructure (buildings, structures, devices), that provides functioning and operation of different transport types (vehicles). Transportation of cargoes without such material basis is either impossible (e.g., railway tracks for trains, stations for pumping over the oil products into oil pipelines, etc.), or economically unsuitable (e.g., motor-roads for trucks and passenger buses) [3].

N. Iksarova defines that transport infrastructure consists of marine transport, inland water transport, auto transport, railway transport, air transport and pipeline transport including appropriate objects – harbours, roads, airports, railway stations, warehouses and other ancillary facilities. [4].

Thus, on the basis of the reviewed approaches to give the definition of the transport infrastructure we can draw a conclusion that transport infrastructure contains communication lines, complex of all transport types, mobile transport structure, and logistics companies.

Transport infrastructure of Ukraine is a complex system which numbers 6 railways, JSC «Ukrrihflot», 34 airlines, 657 auto transport enterprises, 50,000 km of pipelines. For examination of the transport infrastructure functioning the following criteria were chosen: length and density of automobile roads, cargo transportations volume, and main cargo types carried according to the transport types, dynamics of passenger transportations.

Length of automobile roads for general use (see the table 1) is 163,000 km, from which 159,400 km or 97.8% - are firm covering. Comparing to other countries, roads length in Italy 4. 8 times more (815,000 km), in Great Britain – 2.4 times (416,000 km), in Finland – 1.9 times (317,000 km), in Germany -1.4 times (231,000 km). Approximately on the same level stays Spain (164,000 km) [5]. Density of transport system is distance of communication lines that suit to 1,000 km<sup>2</sup> of the

country area. Density of transport is irregular value. It's determined due to the transport types (density of automobile roads, density of railway lines net, etc.)

Analysis of automobile roads density in 2010-2013 showed that ratio of roads length per 1,000 m<sup>2</sup> of the territory of Ukraine almost didn't change, and since 2014 it's been observed that density of railway tracks has been reduced by 1.1 km/ 1000 m<sup>2</sup>, of automobile roads by 10.9 km/ 1,000 m<sup>2</sup>, inland water transport ways by 0.8 km/ 1,000 m<sup>2</sup>.

The reasons of such indexes are: damaged infrastructure of Donetsk railway, annexation of the Crimea peninsular, partial destruction of the roads on the East of Ukraine.

In our previous researches we mentioned that according to the current tendencies it is possible to presume that number of motor cars will increase almost 3 times by 2026 comparing to 2000 [6]. In terms of limited financing more than 90% of automobile roads for general use haven't been repaired for over than 30 years.

Therefore automobile roads for general use (169,600 km) don't meet modern requirements as according to the firmness (39.2%) as flatness (51.1%). Additionally artificial structures and bridge crossings need special attention to be paid. From 16,191 bridges only 7,471 of them meet the operating norms and standards, 1,865 of bridge crossings need urgent repairing.

Table 1 – Length and density of Ukrainian transport system in 2010–2014

Indexes	Years				
	2010	2011	2012	2013	2014
Length of lines, km					
Operational length of railway tracks for general use	21,684.2	21,644.4	21,619.4	21,604.9	20,948.1
Including electrified	9,853.7	10,067.2	10,242.2	10,237.5	9,975.5
Length of automobile roads for general use	169,496.2	169,636.8	169,693.9	169,648.5	163,027.6
Including firm covering	165,843.6	166,024.6	166,095.1	166,084.9	159,463.2
Operational length of inland water transport ways for general use	2,184.7	2,144.7	2,125.7	2,120.7	1,613.1
Density of transport lines. km per 1,000 m <sup>2</sup> of the territory of Ukraine					
Operational length of railway tracks for general use	36.0	35.9	35.9	35.8	34.7
Length of automobile roads for general use	281.1	281.3	281.4	281.3	270.4
Operational length of inland water transport ways for general use	3.6	3.6	3.5	3.5	2.7

Transportations volume is a number of cargoes either transported or declared by consignor and received by carrier for delivery to recipient [7].

General dynamics of cargo transportations is shown in Table 2, where we can see that the most part of transportations in Ukrainian transport system are performed via automobile (61%) and railway (37%) transport types, the part of transportations via marine and air transport is insignificant. During 2010-2014 decrease in transportation of cargoes via all transport types has been observed. Reflection of such negative dynamics is found, on the one hand, in decrease of

chemical products, iron and manganese ores export as a result of military operations at the territory of Donbass; and from the other hand, lack of investments in transport branch.

The main branches in the sphere of railway transport supplying cargoes always were fuel and energy complex (mines, electric power stations and oil processing), mining complex (ore materials, coke, metallurgy) and construction (sand, breakstone chips, cement) [8]. Cargoes are carried via automobile transport mainly to meet personal requirements and mostly for short

distances, via inland water transport cargoes are carried for mining complex and construction.

Table 2 – Dynamics of cargo transportations according to the transport types

Transport type	mil. tonnes	mil. tonnes	mil. tonnes	mil. tonnes	mil. tonnes
	% in 2009	% in 2010	% in 2011	% in 2012	% in 2013
Railway: departures	358.0	388.7	378.1	377.3	325.1
	111.1	108.6	97.3	99.8	86.2
Railway: transportations	432.8	469.3	457.4	443.6	386.2
	110.5	108.4	97.5	97.0	87.1
marine	4.0	4.1	3.4	3.4	2.8
	87.0	102.5	82.9	100.0	82.4
inland water	6.9	5.7	4.2	2.8	3.1
	135.3	82.6	73.7	66.7	110.7
automobile	1,168.2	1,252.3	1,259.6	1,260.7	1,131.3
	109.3	107.2	100.6	100.1	89.7
aircraft	0.09	0.09	0.12	0.10	0.08
	103.3	104.8	133.1	80.9	79.2

Passenger transportation volume is a number of passengers who are carried by the certain transport type. During the last few years a tendency of decreasing passenger transportation volumes is observed among almost all transport types. The most specific weight in passenger transportation take railway (50.5% – in 2014) and automobile (49.4% – in 2014) transport types. The leading hand in transport system of Ukraine belongs to the railway transport.

Ukrzaliznytsya is one of the biggest enterprises in railway branch which performs transportations via local and international communication links and consists of 6 railways: Prydniprovsk, Donetska, Pivden, Pivdenno-Zachidna, Odeska, Lvivska. Passengers departures by railway transport in Ukraine has decreased during the period from 2010 till 2014 (excluding the temporary occupied territory of the Autonomous Republic Crimea, city of Sevastopol, and part of the ATO zone) (including transportations by the city electric train) by 8.9% – 37.9 mil of people. Such negative tendency is observed due to annexation of the Crimea and carrying out the ATO, in the eastern regions of the country some routes for passenger trains in the direction of Donetsk, Luhansk cities and the Crimea were cancelled and changed into the routes with less distance. Taking into account the situation in the east of the country, damage done to the Donetsk railway infrastructure and annexation of the Crimea no positive tendencies are observed in the sphere of passenger transportations via railway transport in 2015.

Carrying of passengers and cargoes by automobile transport is performed mainly for mean distances. Average distance for carrying one passenger by automobile transport in 2013 was 15 km (for international connections – 505 km) [9]. Automobile transport service was used in 2014 by 2,913.3 mil of passengers, that is by 21.8% less than in 2010. In spite of the fact that positive dynamics is observed in carrying by air transport – in 2014 there were transported by 6% more passengers than in 2010 - it should be mentioned that significant reduction of transportations took place in 2014 comparing to 2013 (20%), negative results

were reflected also in 2015 – volumes of passenger transportations by Ukrainian airlines decreased by 2.7% comparing to 2014, that shows deepening of economic crisis, aggravation in military and political situation, closure of air communications with Russia and reduction in demand for air transportation accordingly.

Marine transportation is developed in the Black Sea and the Crimea regions. Inland water transport is available in Kyiv, Central, and Prydniprovskiyi regions. Inland water transport has significant potential as it numbers 3 sailable rivers, 2 of them belong to the 5 biggest rivers in Europe, and 16 river harbours. Despite the significant potential of the inland water and marine transport it is observed rapid decrease in carrying by water transport that is also a negative result of the Crimea annexation.

Main problems of Ukrainian transport infrastructure can be divided into external and internal.

External problems include decrease in paying capacity in the country, significant inflation level, financial and currency instability, raise of prices for energy sources and materials.

Internal problems are represented by lack of own income and financing from the budget, deficiency of investments and state sustention of the innovative development of the branches, that causes considerable depletion of main vehicles, technical lagging of all transport types and services from European transportation standards.

Also, renewal of the transport fleet is suspended by the fact that transport system performs not only state functions, but social as well that is reflected in carrying passengers of preferential categories and operating of unprofitable lines. Economically baseless calculation of fares intensifies unprofitability of the transport sphere. This leads to violation of directives of the European Union – financing passenger transportations at the expense of cargo ones. L. Kotyuchenko, A. Dzus accent that potential of the transport and roads complex is not entirely revealed regarding to the export development of the transport services [10].

It should be noted that there is a number of other problems: transport service which is provided doesn't meet social standards and modern cities requirements; the existing transport infrastructure is not used in the optimal way; low level of regulatory and legal support of the branch.

Table 3 – Dynamics of passenger transportations according to the transport types

Years	2010	2011	2012	2013	2014
Transport type	mil. of passengers / % in 2009	mil. of passengers / % in 2010	mil. of passengers / % in 2011	mil. of passengers / % in 2012	mil. of passengers / % in 2013
railway	427.2	429.7	429.1	425.2	389.3
	100.3	100.6	99.9	99.1	91.6
automobile (buses))	3,726.2	3,611.8	3,450.1	3,343.6	2,913.3
	92.8	96.9	95.5	96.9	87.1
aircraft	6.1	7.5	8.1	8.1	6.4
	119.6	123.0	108.0	100.0	79.0
water	7.6	8.0	6.6	7.2	0.5
	98.7	105.3	82.5	109.1	6.9

The problems mentioned above restrain economic development and implementation of social programs. Therefore, rising of the operational level of the transport infrastructure is one of the main tasks which has to be resolved:

- development of railway transport requires renewal of vehicles, expansion of routes length;
- development of automobile communications requires maintenance of the roads, that will bring international highways to European standards. It's also necessary to take into consideration the fares policy of the government and financing system of the public transport as many transport enterprises are unprofitable;
- an important ground for development of the water transport in Ukraine is reestablishment of marine transportations, return of the water zone at the annexed territory, reconstruction and technical innovation of harbours, withdrawal of obsolete transport means from exploitation;
- priority in the development of the national aircraft should become the policy of the leading airlines in Ukraine, which is aimed at integration of domestic and foreign flights, renewal of the basic transport means.

It should be taken into account that attracting the private sector to finance transport projects will allow the creation of innovative projects and will promote the development of new ideas for financing, designing and exploitation. The private sector is interested in minimal construction delays in order to reduce own costs and provide the quickest payback of the investments.

Investing into the transport infrastructure has more risks than any other project, so these risks and ways of their distribution may become a considerable barrier in attraction of the private financing. A significant advantage in financing projects of the transport infrastructure is distribution of the risks between state institutions and private sector. Each risk is hold by the party which is most capable to control it.

The experience of many countries demonstrates the advantages of partnerships between state and private businesses in the development of the transport infrastructure and allows to control over important state assets to be maintained.

Partnership between state and private sectors makes it possible to get more income than it can be given by the state budget. Costs of paying for the private partnership are compensated, as a rule, at the expenses of effective economy: providing the best service with the least expenses. State institutions in such partnership appear as a strategic investor, who defines clear goals, performs management of the projects and controls their implementation. State sector has the right to decide how actual the project is according to the society benefits, but at the stage of project implementation and defining of the financing type it is necessary to attract private sector.

Conception of partnership is considered in the leading countries of the EU as an innovative solution combining effectiveness, commercial dynamism and observance of public interests to provide modernization and development of the public transport. Nowadays there are several successful projects of the partnership between state and private sectors in the transport infrastructure: the first paid highway M6 in Great Britain, Tunnel Rail Link (GB), Eurotunnel under the English Channel, and Central Park in New York.

Though it should be mentioned that accumulated experience connected to the transport projects financed by private sources differs in its kinds. Mexican program for creating the system of paid highways faced the difficulties caused by inaccurate estimates of transport demand and incomes, underestimation of expenses and terms for paying debts, which were adapted to the projects needs incorrectly. Projects "Dulles Greenway" in the United States and "Orly VAL" in France faced problems due to the lower income than expected. Inaccurate primary estimation of the construction project for the tunnel under the English Channel lead to overexpenditure of costs, delays and lower incomes comparing to the expected ones, and to the necessity of financial reorganization of the project. Attraction of the partnership between state and private business will secure higher technical and economical indexes of effectiveness in activity of the transport branch, than in case of attraction of state institutions only. Considerable potential of this

institution and its further development will secure effective use of the available resources in the transport infrastructure.

Several projects in central Europe were tied up (e.g., construction of the bridge in Szekszárd, Hungary), or tenders for concessions were cancelled (highway D5, Check Republic), or due to different financial and legal considerations offers for limited financing according to the market prices were rejected in favor of other variants (airport Ruzyně, Prague, Check Republic; airport Ferihegy, Budapest, Hungary). Reasons in each case were different, but predominant factors were the following:

- low financial capacity (especially in case of projects for highways constructions);
- financial moderateness from the society point of view and political eligibility;
- insufficient level of local financing.

Even if accumulated at the moment experience of operating transport projects financed by private sources has mixed features, reasons for private sector to take part in infrastructure projects are still very persuasive. Projects financed by private sources suppose observance of commercial discipline, use of the experience in effective management of private enterprises, protection of the infrastructure from excessive political interference and reduction of the load of the state borrowing by means of attraction additional funds.

A number of such foreign countries as USA, Japan, EU countries have a method to combine state and private funds – setting up of the institutions that in legal sense are independent from a state or any local authority and have their own corporative status [11]. This method was widely used in Western Europe for different transport types. It allows to mobilize considerable amounts of state and private funds, often with state guarantee for loans. This type of legal and organizational institution fits to the variety of financial

mechanisms. Efficiency of such institutions and financial mechanisms will depend on the level of company freedom and state interference. Such institutions are also acceptable in case of concessions and construction agreements, exploitation and transfer. French system of paid highways is an example of such an agreement. The paid highways are ruled by half state companies which are controlled by state holding company accordingly.

**CONCLUSION.** Ukraine has considerable potential for the development of the transport infrastructure and transit ability, which could raise indexes of export to the European countries. Unfortunately, the main features of the current state of the transport operation system in Ukraine are a total lack of financing this branch, a rapid decrease in passenger turnover and cargo transportation, vehicles are in a critical situation and have 80% of depletion, as a result working balances of transportation capacity are almost exhausted. This negatively reflects the dynamics of transit transportations across Ukraine with respect to providing a good quality service of in transport branch.

For the effective development of the transport branch in Ukraine in future years the following tasks are necessary: to meet requirements of the national economy and population in transportations, to raise quality and availability of transport services, to modernize main vehicles, to increase the security level while carrying, to decrease pollution volume thrown into the atmosphere, to raise transport capability, speed of transportations, to develop the net of automobile roads, to draw the transport system of Ukraine closer to the connection with the European system, and to create logistics centres functioning effectively.

The suggested approaches for development of the transport infrastructure in Ukraine are the further direction for investigation.

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