

UDC 625

JEL Classification: L92

Soroka A.V.^a, Khomenko I.O.^a, Volynets L.M.^b

CURRENT STATE AND DEVELOPMENT PROSPECTS OF THE ROAD AND TRANSPORT INFRASTRUCTURE OF UKRAINE

^a Chernihiv Polytechnic National University, Chernihiv, Ukraine^b National Transport University, Kyiv, Ukraine

The article is devoted to current issues of the state of Ukrainian roads and the importance of repairing and updating road sections. The structure of public highways in Ukraine is analyzed. An analysis of the State target economic program for the development of public highways of state importance for 2018-2022, the purpose of which is the development and restoration of public highways of state importance. The amount of funding for the development and maintenance of public highways by type of work was considered. The innovation of the reform in the field of the road industry carried out in 2018 was studied, in particular, the creation of a single target fund for financing the industry – the State Road Fund, and the sources of its filling were also determined. Funding sources for road infrastructure have been identified. An analysis of the structure of financing of the road and transport infrastructure of Ukraine for 2018-2020 was made, while the trend from the introduction of decentralization of road management was traced. The structure of highways in Ukraine by type of surface was analyzed and conclusions were drawn regarding its modification. The main problems preventing the implementation of the European road management system have been identified. In particular, inadequate funding and ineffective redistribution of available financial capital between the structure of public highways and types of works for their renewal and repair. In addition, the implementation of European standards in the field of road infrastructure is also hindered by the inadequate use of available opportunities and technologies. One of these technologies is an asphalt-concrete mixture loader, which reduces the likelihood of potholes and rutting on roads in the future, as well as the construction of cement-concrete roads, which are practically non-existent in Ukraine, but in the countries of the European Union, their share in the structure is the vast majority.

Keywords: highways, transport infrastructure, program, financing, road surface.

DOI: 10.32434/2415-3974-2022-17-1-108-115

Formulation of the problem

Undoubtedly, the state of highways in Ukraine is one of the worst in the world. The state of the road and transport infrastructure directly affects road safety, access to services, tourist attraction and, most importantly, the competitiveness of the domestic economy. The development of transport connections has a significant impact on the employment and income of the population, as well as the satisfaction

of their personal needs. The condition of the roads has an impact on the formation of prices for goods and services, supporting the flow of labor resources. In fact, the proper condition of the road and transport infrastructure is one of the main factors of the country's economic development.

The main problems of the road industry in Ukraine are insufficient financial support for the functioning of road enterprises, an outdated

© Soroka A.V., Khomenko I.O., Volynets L.M. 2023



This article is licensed under Creative Commons Attribution 4.0 International License (CC-BY)

Soroka A.V., Khomenko I.O., Volynets L.M.

management system, ineffective quality control, a lack of innovations and improvements in the field of road construction, as well as an increase in the intensity of traffic and the load on roads. The presence of these problems determines the relevance of the study of the current state, main trends and prospects for the development of the road and transport infrastructure of Ukraine.

Analysis of recent research and publications

The issue of the state and prospects of development of the road industry in Ukraine occupies a special place in modern scientific literature. A. V. Basiluk, M. M. Burmaka, T. V. Dedilova, I. A. Dmitriev, I. H. Kantsur, V. V. Kontseva, I. A. Protsenko, I. P. Sadlovska, O. O. Saint and a number of other scientists highlighted the problems of improper development of the road and transport infrastructure, as well as the system of financing the road industry, in his writings.

Formulation of the goals of the article

The purpose of the study is a general analysis of the functioning of the road and transport infrastructure of Ukraine, as well as the development of scientifically based proposals for the further development of the network of public highways, based on financial opportunities and trends.

Presentation of the main research material

The length of the highway network in Ukraine is about 170,000 km (including Crimea and the temporarily occupied territories), including 166,000 km of paved roads and 3,600 km of unpaved roads [1].

According to the indicator of road quality, Ukraine ranks last in international rankings. For example, according to the data of the World Economic Forum, in 2018, Ukraine took 123rd place in the world out of 137 participating countries in the rating [2].

It is worth noting that the quality of highways in Ukraine differs in different sections and mainly depends on their importance for the country’s economy. Most of the international and national roads are in a more or less satisfactory condition, but such connections make up only 30% of the

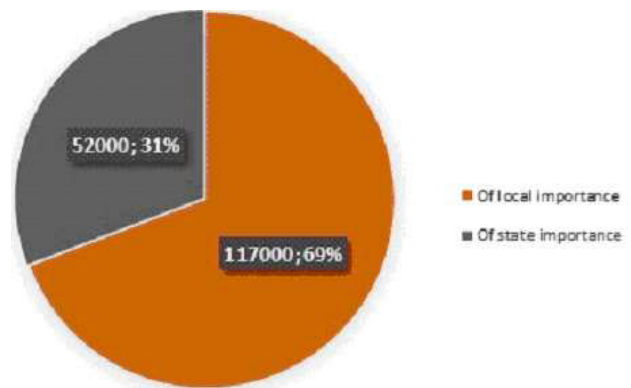


Fig. 1. The structure of public highways of Ukraine
Source: created on the basis of data from the Ministry of Infrastructure of Ukraine, km. [1]

structure of public highways, the basis for Ukraine, almost 70%, are roads of local importance (Fig. 1), most of which sections are in an emergency state situation, requiring major repairs almost from scratch. In fact, this indicates that the majority of roads in Ukraine are in an unsatisfactory condition, so the issue of road quality is on the agenda.

During 2017-2018, the 2018-2022 Program was developed and approved on March 21, 2018, the purpose of which is the development and restoration of public roads of state importance in order to integrate them into the European transport system and increase the level of traffic safety, speed, comfort and economy on them transportation [3].

According to the state target economic program for the development of public highways of state importance for 2018-2022, the amounts of funding were approved according to the types of works (Table 1).

The lowest share of financial resources is directed to major repairs and new construction, the capital is concentrated on average repairs, which will not be effective for roads in critical and emergency condition, the main part of which is concentrated in Ukraine. That is why investing significant funds in the development of highways will not bring the desired result. This shows that the structure of the amount of funding according to the types of work

Table 1

Volumes of financing for the development and maintenance of public highways by type of work

Type of works	Volume of works from all sources		
	Provided by the 2018-2022 Program		
	million UAH	kilometer	long meter
New construction and reconstruction	3326.7	14.8	332.9
Overhaul	1711.2	40.0	577.7
Current average repair	19388.0	1514.8	2612.2
In total	24425.8	1569.6	3522.8

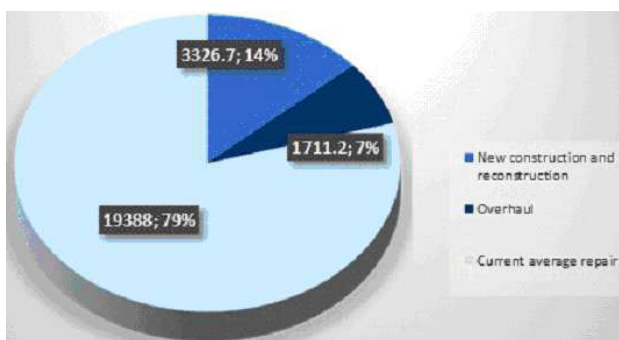


Fig. 2. Financing structure of highways according to their types of work, mln. UAH

Source: compiled on the basis of data from the State Target Economic Program for 2018-2022 [4]

needs to be changed and redistributed in favor of major repairs, and only then will visible changes for the better begin (Fig. 2).

The network of public highways formed in the 60s and 70s of the 20th century, under the conditions of a planned centralized management system, was intended primarily to ensure intrastate transportation. Thanks to the introduction of the State Road Fund and the search for additional sources of funding, large-scale projects in the field of road construction and repair were implemented in 2018-2020.

According to the route principle, the main highways of Ukraine that connect regional centers are being restored, which contributes to the development of the country's transit potential and economy.

The State Agency of Highways of Ukraine (Ukravtodor) is the central body of the executive power, whose activities are directed and coordinated by the Cabinet of Ministers of Ukraine through the Minister of Infrastructure and which implements state policy in the field of road management, therefore it has no competitors in this matter.

The main task of highway services in the regions is the organization of maintenance in proper technical condition and the development of a network of public highways, bridges and artificial structures, creating conditions for continuous and safe traffic on them, meeting the needs of the national economy and the population of Ukraine in improvement and rational development maintained road infrastructure.

The main objective of the activity of the Joint-Stock Company "State Joint-Stock Company "Roads of Ukraine" is to ensure the economic interests of the state, meet the needs of the state, the population and the defense of the country in the improvement and development of public highways, expanding the possibilities of industrial and social

development of road enterprises, increasing the efficiency of use material, financial and other resources based on joint activity, division of labor and cooperation.

State enterprises, in accordance with their areas of activity, provide [4]:

- development of theoretical principles, experimental laboratory and field studies, implementation of work results in the practice of construction of roads and bridges, their maintenance, inspection, repair and reconstruction with development of regulatory and instructional support;

- current management of preparation and implementation of investment projects;

- ensuring monitoring of compliance with regulatory requirements during the construction, repair and maintenance of highways and artificial structures, promoting the improvement of the operational condition of highways and artificial structures, road construction materials, metrological support, testing equipment, development and organization of information technologies;

- development of projects of bridges, other artificial structures, objects of the production base of bridge construction, engineering structures of civil construction, conducting expert evaluation and scientific substantiation of the operational condition of bridge structures, carrying out special surveys and tests, design and technological support for the passage of heavy road trains over bridge structures, independent expert assessment on the operation of bridge structures;

- implementation, improvement, development of means of communication, technical means of automation, organization of functioning of the information support system on public roads;

- ensuring the realization of the needs of individuals in mastering working professions, specialties, qualifications in accordance with their interests and abilities;

- rehabilitation, treatment and preventive measures to support and restore the health of road industry workers who suffered as a result of the Chernobyl disaster, participants in anti-terrorist operations, etc.

Among the main goals of the strategic development of Ukravtodor, the following can be distinguished [3]:

- increasing the safety of transport processes, reducing risks to people's lives and health during the transportation of passengers and cargo;

- the introduction of energy-efficient and environmentally friendly technologies, the introduction of international environmental standards

“EURO-5” – “EURO-6” for vehicles and motor fuels, ensuring the possibility of identification of vehicles in terms of their compliance with environmental standards in order to give advantages on the market to carriers that use more advanced vehicles by design;

– ensuring the availability and quality of transport services for all categories of passengers throughout the state, in particular for persons with disabilities;

– increasing the efficiency and competitiveness of the road transport industry and road management, creating a favorable business climate, promoting the improvement of the efficiency of operators of motor transport services, the structure of vehicles, the use of modern transport technologies, the realization of the transit potential of the transport system;

– regulation of international transportation by road, which will contribute to the liberalization of transportation;

– ensuring the preservation of roads due to compliance with requirements for vehicles and strengthening control over compliance with these requirements;

– improving the quality of service for drivers and passengers on public roads;

– settlement of relations between carriers and operators of forwarding services. Ensuring a balance between users of road freight transport and transport network services;

– reforming the road industry to ensure the development and maintenance of the road network in good condition;

– attraction of investors for the construction and maintenance of roads, which ensure an increase in average speeds and comfort of road traffic;

– introduction of modern technology of construction, arrangement and maintenance of roads;

– management and operation of the road network to ensure the reliability and efficiency of transportation;

– introduction of independent work quality control;

– ensuring the preservation of roads.

In 2018, the reform of the road industry was carried out, as a result of which a single dedicated fund for financing the industry was created – the State Road Fund. The main source of filling the fund is the excise duty on fuel. That is, those who use it actually pay for the road. In addition, financing of road infrastructure also takes place at the expense of funds from international financial organizations and investors.

The largest amount of financial resources for the development of the road industry was planned to be allocated in 2020. At the same time, the basis of financial support for the implementation of the program is concentrated from the state budget, although the share of funds from investors grows annually and reaches a significant value. In general, the implementation of the program for the development and maintenance of public highways takes place precisely at the expense of state funds (Table 2).

In accordance with the above-mentioned reform in the field of the road industry, in 2018, the management of the road industry was decentralized. As a result, 120,000 kilometers of roads of local importance were transferred to regional authorities. Only 50,000 km of roads of state importance remained on the balance sheet of Ukravtodor. Funding was similarly decentralized (Fig. 3) [5].

According to Fig. 3, a fairly positive trend can be observed from the introduction of decentralization of road management. Year after year, local budgets began to receive a larger share of financial resources for the development of the road industry, i.e., the effect of such reform became noticeable already in a short period of time, and in the case of further competent management and control, a solution to the problem of the catastrophic condition of roads at the local level is possible. In fact, such decentralization in the field of public sector management gave an additional stimulus to the economic development of entire regions of the country, which will create conditions for a large-

Table 2

Financing structure of the road industry from various sources

Source of funding	Amount of financing, mln. UAH				
	2018	2019	2020	2021	2022
Funds of the special fund	20025.46	35 217.33	68 395.43	46 132.37	47653.04
Funds of the general fund	6 302.31	766.48	27 639.55	–	–
Funds of international financial organizations	3 722.27	4 463.64	4 440	3 910.3	3 719.25
Other sources, including funds from investors	–	514.1	18 043.47	36 051.17	46 172.58
In total	30050.04	40 961.55	118 518.45	86 093.83	97 544.87

Source: compiled according to the State Target Economic Program for 2018–2022 [4]

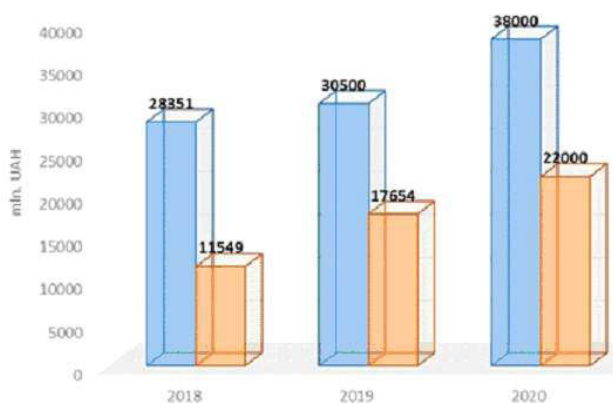


Fig. 3. Financing volumes of road and transport infrastructure of Ukraine by destination in 2018-2020

Source: compiled on the basis of data from the Concept of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022 [5]

scale renewal of the road industry throughout Ukraine by introducing a European system of sector management.

In addition to insufficient financing of the road transport industry, another problem that prevents the implementation of European standards in the field of road infrastructure is the incomplete use of available opportunities and technologies (Fig. 4).

One of such technologies is a loader of asphalt concrete mix. Such loaders provide additional mixing of the asphalt concrete mixture before laying. This allows to equalize its temperature and composition, increase the density and evenness of the coating, and therefore the quality. The essence of the technology is that during the laying process, the asphalt concrete mixture is thoroughly mixed and heated to the required temperature in the loader and is continuously fed to the asphalt paver. Thus, the problem of temperature and fractional segregation is solved, so the quality of the road surface can be increased by a total of 30%. Also, there will be no potholes, cracks and spalling, the likelihood of pitting and rutting in the future is reduced [6].

Asphalt concrete mixture loaders are used for a number of reasons: to obtain a constant temperature of the mixture that passes through the asphalt paver (elimination of temperature segregation); prevent segregation of aggregates by mixing the mixture (elimination of fractional segregation); ensure a continuous laying process; to eliminate the probability of the dump truck hitting the paver, preventing the occurrence of a transverse crack.

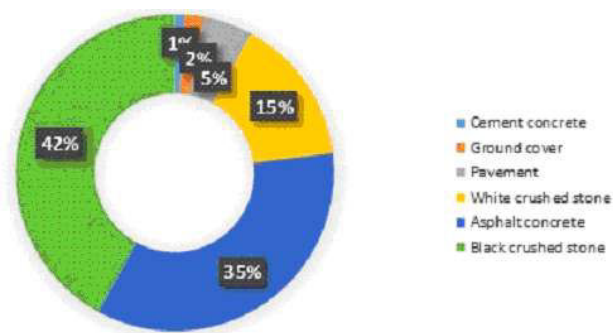


Fig. 4. Structure of highways in Ukraine by type of surface
Source: compiled on the basis of data from the Ministry of Infrastructure of Ukraine [7]

Another possible solution to the problem of road quality in Ukraine is the construction of cement concrete roads. There are practically no concrete roads in Ukraine today. Their specific share in the road network is about 1%.

At the same time, operating experience shows that under any climatic conditions, at any intensity and any composition of traffic, cement concrete pavements are more durable (20-30 years) than asphalt pavements (8-12 years) [9].

Another advantage of concrete roads is the national component. Asphalt roads have an imported component – this is bitumen, which occupies 8-10% by mass. And if we talk about the cost, then 56-60%. Analyzing where Ukraine takes bitumen, it turned out that we import approximately 100 million dollars worth of bitumen per year. If we talk about trends, after the creation of the Road Fund, and accordingly the increase in the number of roads that are being repaired and built, the demand for bitumen has increased.

As for cement, Ukraine is quite capable of ensuring its production in the required quantity. We have approximately 30-40% underutilized capacities of cement plants.

In addition to much higher reliability, cement-concrete coatings have a number of other important economic advantages, such as: creation of new jobs due to the almost complete local component of the cost price; the fuel consumption of cars driving on a concrete road is lower – and this is an additional significant benefit to society [8].

The first projects with a cement concrete coating have already been implemented on the Kyiv-Dnipro road N-31 in the Poltava region [7]. Behind this technology really lies a high potential that must be implemented in the road infrastructure of Ukraine.

Conclusions

Based on the conducted research, it can be concluded that the field of road management of Ukraine is not in the best condition, but it has great prospects for development and investment. 97% of Ukrainian roads do not meet the necessary norms and standards. A significant problem over the years has been the underfunding of the sector or the need to redistribute available financial resources to the type of capital construction works. In this matter, it was possible to achieve certain successes, for example, in recent years there has been a positive trend in increasing the amount of funding for road works, and this is a consequence of the creation of the targeted Road Fund. In addition, the capacity of the fund improved also due to the attraction of funds from international investment institutions. An important achievement was also the introduction of the European system of management of the road industry, which provides for the possibility of decentralization, which allows filling local budgets, and therefore financing road projects on the ground. But this innovation is not yet perfect and needs further special control over its implementation and improvement. Nevertheless, in recent years, it has already been possible to redistribute funds in favor of local authorities. The introduction of modern technologies is the next stage on the way to improving the situation in the field of road transport in the country. This applies both to the construction of roads with a cement concrete coating, and to the introduction of the use of an asphalt concrete mixer in the laying process. Despite the visible shortcomings in the field of road and transport infrastructure, the formed trends clearly indicate the first positive results of the strategic development of the road industry in Ukraine.

REFERENCES

1. Ministerstvo infrastruktury Ukrainy, Shchorichnyy byuleten «Protyazhnist i kharakterystyka avtomobilnykh dorih zahalnoho korystuvannya» [Ministry of Infrastructure of Ukraine, Annual Bulletin “Length and Characteristics of Public Roads”]. (n.d.). *mtu.gov.ua*. Retrieved from <https://mtu.gov.ua/content/inshi-vidomosti.html> [in Ukrainian].
2. Site of the World Economic Forum, The Global Competitiveness Report 2018. *www.weforum.org*. Retrieved from <http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf> [in English].
3. Postanova Kabinetu Ministriv Ukrainy vid 21 bereznya 2018 r. № 382 «Pro zatverdzhennya Derzhavnoi tsilovoi ekonomichnoi prohramy rozvytku avtomobilnykh dorih zahalnoho korystuvannya derzhavnoho znachennya na 2018-2022 roky» [Resolution of the Cabinet of Ministers of Ukraine dated March 21, 2018 No. 382 “On approval of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022”]. *www.kmu.gov.ua*. Retrieved from <https://zakon.rada.gov.ua/laws/show/382-2018-%D0%BF#Text> [in Ukrainian].
4. Zakon Ukrainy “Pro zatverdzhennya Derzhavnoi tsilovoi ekonomichnoi prohramy rozvytku avtomobilnykh dorih zahalnoho korystuvannya derzhavnoho znachennya na 2018-2022 roky” [The Law of Ukraine “On Approval of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022”]. (n.d.). *zakon.rada.gov.ua*. Retrieved from <https://zakon.rada.gov.ua/laws/show/382-2018-n#Text> [in Ukrainian].
5. Postanova Kabinetu Ministriv Ukrainy vid 11 sichnya 2018 r. № 382 «Pro skhvalennya Kontseptsiyi Derzhavnoi tsilovoi ekonomichnoi prohramy rozvytku avtomobilnykh dorih zahalnoho korystuvannya derzhavnoho znachennya na 2018-2022 roky» [Resolution of the Cabinet of Ministers of Ukraine dated January 11, 2018 No. 382 “On approval of the Concept of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022”]. (n.d.). *www.kmu.gov.ua*. Retrieved from <https://zakon.rada.gov.ua/laws/main/34-2018-%D1%80#Text> [in Ukrainian].
6. Ministerstvo rozvytku hromad ta terytoriy Ukrainy (2019). “Pry ukkladanni asfaltu na naybilshykh trasakh maye zastosovuvats spetsialni perevantazhuvachi – vstupyla v diyu nova budivelna norma” [Ministry of Development of Communities and Territories of Ukraine. When laying asphalt on the largest highways, special loaders must be used – a new building code has come into force]. *www.minregion.gov.ua*. Retrieved from <https://www.minregion.gov.ua/press/news/pri-ukladanni-asfaltu-na-naybilshih-trasah-maye-zastosovuvatis-spetsialni-perevantazhuvachi-vstupila-v-diyu-nova-budivelna-norma/> [in Ukrainian].
7. Sait Ministerstva infrastruktury Ukrainy [Site of the Ministry of Infrastructure of Ukraine]. *mtu.gov.ua*. Retrieved from <https://mtu.gov.ua/> [in Ukrainian].
8. Rishabh Bhandari, Sangram Patil & Ramesh K. Singh (2012). Surface prediction and control algorithms for anti-lock brake system. *Transportation Research Part C: Emerging Technologies, 1*, 181-195. Retrieved from <https://doi.org/10.1016/j.trc.2011.09.004> [in English].
9. Kurt Heutschi, Erik Bhlmann & Jakob Oertli (2016). Options for reducing noise from roads and railway lines. *Transportation Research Part A: Policy and Practice, 1*, 308-322. Retrieved from <https://doi.org/10.1016/j.tra.2016.09.019> [in English].
10. Khomenko, I. O., Volynets, L. M., & Lysenko, O. V. (2021). Ekonomichne otsynuyvannya rozvytku dorih ta transportnoi infrastruktury v konteksti pidvyshchennya yakosti perevezen. [Economic evaluation of the development of roads and transport infrastructure in the context of improving the quality

of transportation]. *Ekonomika ta suspilstvo – Economy and society*, 30 [in Ukrainian].

11. Khomenko, I. O., Volynets, L. M., & Lysenko H. O. (2020). Osoblyvosti derzhavno-pryvatnoho partnerstva yak mekhanizm realizatsiyi novoyi rehionalnoyi polityky dlya funktsionuvannya ta rozvytku dorozhnoho hospodarstva. [Peculiarities of public-private partnership as a mechanism for implementing a new regional policy for the functioning and development of the road industry]. *Naukovyy visnyk Polissya – Polissya scientific bulletin*, 2, 73-82 [in Ukrainian].

Received 30.11.2022.

СУЧАСНИЙ СТАН ТА ПЕРСПЕКТИВИ РОЗВИТКУ ДОРОЖНЬО-ТРАНСПОРТНОЇ ІНФРАСТРУКТУРИ УКРАЇНИ

Сорока А.В., Хоменко І.О., Волинець Л.М.

Стаття присвячена актуальним питанням стану автомобільних доріг України та важливість ремонту й оновлення дорожніх ділянок. Проаналізовано структуру автомобільних доріг загального користування України. Зроблено аналіз Державної цільової економічної програми розвитку автомобільних доріг загального користування державного значення на 2018-2022 рр., метою якої є розвиток і відновлення доріг автомобільного призначення загального користування державного значення. Розглянуто обсяги фінансування на розвиток та утримання автомобільних доріг загального користування за видами робіт. Досліджено нововведення проведеної у 2018 році реформи у сфері дорожньої галузі, зокрема створення єдиного цільового фонду для фінансування галузі – Державного дорожнього фонду, а також визначено джерела його наповнення. Визначено джерела фінансування дорожньої інфраструктури. Зроблено аналіз структури фінансування дорожньо-транспортної інфраструктури України за призначенням у 2018-2020 рр., водночас простежено тенденцію від впровадження децентралізації управління дорожньою галуззю. Проаналізовано структуру автомобільних доріг України за типом покриття та зроблено висновки, щодо його видозмінення. Визначено основні проблеми, що перешкоджають впровадженню європейської системи управління дорожньою галуззю. Зокрема неналежне фінансування та неефективний перерозподіл наявного фінансового капіталу між структурою автомобільних доріг загального користування та видами робіт на їх оновлення й ремонт. Крім того, перешкодою втілення європейських стандартів у сфері дорожньої інфраструктури виступає також неповноцінне використання наявних можливостей і технологій. Однією з таких технологій є перевантажувач асфальтобетонної суміші, що зменшує вірогідність утворення ям і колійності на дорогах у майбутньому, а також будівництво цементобетонних доріг, яких в Україні практично немає, проте в країнах Європейського Союзу їх частка у структурі становить переважну більшість.

Ключові слова: автомобільні дороги, транспортна інфраструктура, програма, фінансування, дорожнє покриття.

CURRENT STATE AND DEVELOPMENT PROSPECTS OF THE ROAD AND TRANSPORT INFRASTRUCTURE OF UKRAINE

Soroka A.V.^a, Khomenko I.O.^a, Volynets L.M.^b

^a Chernihiv Polytechnic National University, Chernihiv, Ukraine

^b National Transport University, Kyiv, Ukraine

* e-mail: nastiasoroka03@gmail.com

Soroka A.V. ORCID: <https://orcid.org/0000-0001-9197-158X>

Khomenko I.O. ORCID: <https://orcid.org/0000-0002-0839-4536>

Volynets L.M. ORCID: <https://orcid.org/0000-0002-5064-2349>

The article is devoted to current issues of the state of Ukrainian roads and the importance of repairing and updating road sections. The structure of public highways in Ukraine is analyzed. An analysis of the State target economic program for the development of public highways of state importance for 2018-2022, the purpose of which is the development and restoration of public highways of state importance. The amount of funding for the development and maintenance of public highways by type of work was considered. The innovation of the reform in the field of the road industry carried out in 2018 was studied, in particular, the creation of a single target fund for financing the industry – the State Road Fund, and the sources of its filling were also determined. Funding sources for road infrastructure have been identified. An analysis of the structure of financing of the road and transport infrastructure of Ukraine for 2018-2020 was made, while the trend from the introduction of decentralization of road management was traced. The structure of highways in Ukraine by type of surface was analyzed and conclusions were drawn regarding its modification. The main problems preventing the implementation of the European road management system have been identified. In particular, inadequate funding and ineffective redistribution of available financial capital between the structure of public highways and types of works for their renewal and repair. In addition, the implementation of European standards in the field of road infrastructure is also hindered by the inadequate use of available opportunities and technologies. One of these technologies is an asphalt-concrete mixture loader, which reduces the likelihood of potholes and rutting on roads in the future, as well as the construction of cement-concrete roads, which are practically non-existent in Ukraine, but in the countries of the European Union, their share in the structure is the vast majority.

Keywords: highways, transport infrastructure, program, financing, road surface.

REFERENCES

1. Ministerstvo infrastruktury Ukrainy, Shchorichnyy byuletен «Protызhnist i kharakterystyka avtomobilnykh dorih zahalnoho korystuvannya» [Ministry of Infrastructure of Ukraine, Annual Bulletin “Length and Characteristics of Public Roads”]. (n.d.). *mtu.gov.ua*. Retrieved from <https://mtu.gov.ua/content/inshi-vidomosti.html> [in Ukrainian].
2. Site of the World Economic Forum, The Global Competitiveness Report 2018. *www.weforum.org*. Retrieved from <http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf> [in English].
3. Postanova Kabinetu Ministriv Ukrainy vid 21 bereznya 2018 r. № 382 «Pro zatverdzhennya Derzhavnoyi tsilovoyi ekonomichnoyi prohramy rozvytku avtomobilnykh dorih zahalnoho korystuvannya derzhavnoho znachennya na 2018-2022 roky» [Resolution of the Cabinet of Ministers of Ukraine dated March 21, 2018 No. 382 “On approval of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022”]. *www.kmu.gov.ua*. Retrieved from <https://zakon.rada.gov.ua/laws/show/382-2018-%D0%BF#Text> [in Ukrainian].
4. Zakon Ukrainy “Pro zatverdzhennya Derzhavnoyi tsilovoyi ekonomichnoyi prohramy rozvytku avtomobilnykh dorih zahalnoho korystuvannya derzhavnoho znachennya na 2018-2022 roky” [The Law of Ukraine “On Approval of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022”]. (n.d.). *zakon.rada.gov.ua*. Retrieved from <https://zakon.rada.gov.ua/laws/show/382-2018-n#Text> [in Ukrainian].
5. Postanova Kabinetu Ministriv Ukrainy vid 11 sichnya 2018 r. № 382 «Pro skhvalennya Kontseptsiyi Derzhavnoyi tsilovoyi ekonomichnoyi prohramy rozvytku avtomobilnykh dorih zahalnoho korystuvannya derzhavnoho znachennya na 2018-2022 roky» [Resolution of the Cabinet of Ministers of Ukraine dated January 11, 2018 No. 382 “On approval of the Concept of the State Targeted Economic Program for the Development of Public Highways of State Importance for 2018-2022”]. (n.d.). *www.kmu.gov.ua*. Retrieved from <https://zakon.rada.gov.ua/laws/main/34-2018-%D1%80#Text> [in Ukrainian].
6. Ministerstvo rozvytku hromad ta terytoriy Ukrainy (2019). “Pry ukladanni asfaltu na naybilshykh trasakh maye zastosovuvaty spetsialni perevantazhuvachi – vstupyla v diyu nova budivelna norma” [Ministry of Development of Communities and Territories of Ukraine. When laying asphalt on the largest highways, special loaders must be used – a new building code has come into force]. *www.minregion.gov.ua*. Retrieved from <https://www.minregion.gov.ua/press/news/pri-ukladanni-asfaltu-na-naybilshih-trasah-maye-zastosovuvatis-spetsialni-perevantazhuvachi-vstupila-v-diyu-nova-budivelna-norma/> [in Ukrainian].
7. Sait Ministerstva infrastruktury Ukrainy [Site of the Ministry of Infrastructure of Ukraine]. *mtu.gov.ua*. Retrieved from <https://mtu.gov.ua/> [in Ukrainian].
8. Rishabh Bhandari, Sangram Patil & Ramesh K. Singh (2012). Surface prediction and control algorithms for anti-lock brake system. *Transportation Research Part C: Emerging Technologies*, 1, 181-195. Retrieved from <https://doi.org/10.1016/j.trc.2011.09.004> [in English].
9. Kurt Heutschi, Erik Bhlmann & Jakob Oertli (2016). Options for reducing noise from roads and railway lines. *Transportation Research Part A: Policy and Practice*, 1, 308-322. Retrieved from <https://doi.org/10.1016/j.tra.2016.09.019> [in English].
10. Khomenko, I. O., Volynets, L. M., & Lysenko, O. V. (2021). Ekonomichne otsynuyvannya rozvytku dorih ta transportnoyi infrastruktury v konteksti pidvyshchennya yakosti perevezen. [Economic evaluation of the development of roads and transport infrastructure in the context of improving the quality of transportation]. *Ekonomika ta suspilstvo – Economy and society*, 30 [in Ukrainian].
11. Khomenko, I. O., Volynets, L. M., & Lysenko H. O. (2020). Osoblyvosti derzhavno-privatnoho partnerstva yak mekhanizm realizatsiyi novoyi rehionalnoyi polityky dlya funktsionuvannya ta rozvytku dorozhnoho hospodarstva. [Peculiarities of public-private partnership as a mechanism for implementing a new regional policy for the functioning and development of the road industry]. *Naukovyy visnyk Polissya – Polissya scientific bulletin*, 2, 73-82 [in Ukrainian].