РАЦІОНАЛЬНЕ ПРИРОДОКОРИСТУВАННЯ І ОХОРОНА ПРИРОДИ

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TRANSPORT AND ENVIRONMENTAL SAFETY OF CITIES (ON THE EXAMPLE OF LUTSK CITY TERRITORIAL COMMUNITY)

The article examines the transport complex of the Lutsk city territorial community, the transport fleet, and the transport infrastructure. The problems of transport functioning in the territorial community, environmental problems related to the development of transport are analysed. The index of transport and environmental sustainability of the city of Lutsk is calculated. Measures to improve the environmental safety of transport in Lutsk are proposed.

Keywords*: city, urban territorial community, transport infrastructure, environmental problems, index of transport and environmental sustainability of the city.*

Statement of the scientific and practical problem. Modern cities face serious challenges in the field of transport and environmental safety. The growth in the number of cars, traffic intensity and urbanisation leads to a deterioration in air quality, increased noise pollution and exacerbated parking problems. These factors have a negative impact on public health and the overall quality of life in cities. Lutsk city community, like many other cities in Ukraine, faces similar problems. The specifics of the city, its historical development, geographical location and economic features create a unique context for solving transport and environmental problems.

Key aspects of the problem include:

- the impact of the transport system on air quality in the city;
- noise pollution from vehicles and its impact on the health of residents;
- the efficiency of public transport and its role in reducing the environmental burden;
- development of cycling infrastructure as an alternative to car transport;
- parking space management and its impact on the environment;
- introduction of environmentally friendly modes of transport and technologies;
- planning urban space with due regard for the environmental aspects of the transport system.

The study of this problem requires an interdisciplinary approach that combines transport planning, ecology, urban studies and sociology. It is necessary to develop comprehensive strategies that would take into account both the needs of population mobility and environmental safety requirements. The solution to this scientific and practical problem will improve the environmental situation in the Lutsk city territorial community, improve the quality of life of residents and create a model of sustainable transport system development that can be adapted to other cities in Ukraine.

Relevance and novelty of the study. The relevance of the study is due to:

- growing urbanisation, which leads to an increased burden on transport infrastructure and a deteriorating environmental situation in cities;
- environmental challenges - air pollution, noise pollution and greenhouse gas emissions from transport are becoming increasingly critical issues for public health and the planet's climate;
- energy security, dependence on fossil fuels in the transport sector poses risks to the energy security of countries and cities;
- the need to integrate the principles of sustainable development into urban planning and transport policy to ensure the long-term well-being of cities;
- the specific problems of the Lutsk city territorial community require adapted solutions that take into account local features and resources.

The novelty of the study is ensured:

- an integrated approach to solving transport and environmental problems that combines technological, social and urban planning aspects;
- localisation of global solutions and adaptation of global sustainable transport practices to the specific conditions of a medium-sized Ukrainian city such as Lutsk;
- combining methodologies from various fields (transport planning, ecology, sociology, economics) to create a holistic picture of the problem and find optimal solutions;
- participatory approach, which involves the development of a methodology for involving the community in the process of planning and implementing changes in the city's transport system;
- creating and evaluating various scenarios for the

development of the Lutsk transport system, taking into account environmental, economic and social factors;

– developing a transport and environmental sustainability index to assess the efficiency of the city's transport system in terms of environmental safety and sustainable development.

Relation of the article's topic to important scientific and practical tasks. The subject matter of the article is related to the areas of environmental improvement outlined in the Development Strategy of the Lutsk City Territorial Community until 2030 and the Sustainable Energy and Climate Action Plan of the Lutsk City Territorial Community until 2050.

Analysis of recent publications on the research topic. Various aspects of the impact of transport on the environmental safety of cities are considered in the works of Ukrainian and foreign researchers. For example, in the article by Y.F. Gutarevych, V.P. Mateychyk, A.O. Kopach [5], ways to improve the environmental safety of road transport are proposed. The article by P.V. Bosak, N.G. Lukianchuk, V.V. Popovych [3] studies the factors influencing the environmental safety of railway transport, which also causes certain damage to the environment. Traditionally, much attention has been paid to the environmental safety of transport operating on alternative fuels. For example, in the work of Y.N. Burdukina, A.A. Oleynikov, V.M. Popov [4]. Ways to improve the environmental safety of road transport are developed in the papers by V.A. Kashkanov, O.V. Ustyushenko [6] and O.I. Bogatov, V.M. Popov [2]. The relationship between transport operation and urban air pollution is considered in the publications by O. Babenko and L. Yashchuk [1]. Foreign scientific literature also pays much attention to these issues. For example, the article by M. Lindsey, J.L. Schofer, P. Durango-Cohen, K.A. Gray [15] examines the impact of place of residence on car mileage, energy consumption and greenhouse gas emissions. The article by W. Van Beek, H. Derriks, P. Wilbers, P. Morsink, L. Wismans, P. Van Beek [14] analyses the impact of speeding measures on air pollution and traffic safety. The article by J. Luoma, M. Sivak [13] considers the interaction of environmental and safety measures for sustainable road transport. In the context of Lutsk, the study of the impact of transport on air pollution, the ecological state of the territory and environmental safety was started in the monograph by Y. Molchak, V. Fesiuk, O. Kartava [7]. It was continued in the monograph by V.O. Fesiuk [11]. The assessment of air pollution and the impact of urban transport on this process was carried out in the article by V.O. Fesiuk, I.A. Moroz [12].

Presentation of the main material. Lutsk city territorial community is located in the south-eastern part of Volyn Oblast, in north-western Ukraine (Fig. 1). It occupies a part of the Volyn Upland, in particular, the Lutsk-Rivne Forest Ridge. The climate is temperate continental with relatively humid summers and mild winters. Surface waters are represented by the Styr River, its tributaries (Sapalaivka, Zmiinets, Zhyduvka) and ponds in their valleys. Typical chernozems and grey podzolised soils prevail. There are no minerals on the territory of the community. The city of Lutsk itself has coordinates 50°44′52″ north latitude and 25°19′28″ east longitude, with an average height of 181 m above sea level. The total area of the Lutsk city territorial community is 38257 hectares, of which 3960 hectares are directly located in the city of Lutsk. The community consists of the administrative centre of the Volyn region – the city of Lutsk, Prylucky, Zhydychynsky, Boholyubsky, Kniahynynivsky, Zaborolsky starosta districts. The population of the Lutsk city territorial community is 244.6 thousand people, and the city of Lutsk itself is 216 thousand people (Fig. 2) [10].

The total length of the community's asphalt roads is 308.4 km, including 22 km of road bridges and overpasses. Many main streets and avenues are equipped with specially marked bicycle lanes. However, the overall level of cycling infrastructure in the city of Lutsk and the community needs to be improved.

In Lutsk, freight and passenger transportation is carried out by various types of transport: electric (trolleybuses), buses, cars and trucks, and railways. Given the specifics of the community's transport system, ownership and fuel consumption, the city's transport can be divided into three main categories: municipal, public and private.

The characteristics of municipal transport are given in Table 1, and the fuel consumption figures are given in Table 2. Municipal enterprises operate 132 passenger cars, 89 trucks, 32 buses and 169 special vehicles.

In 2022, compared to 2007 (Fig. 3), the consumption of diesel fuel decreased by 1.9 times and liquefied gas by 2.44 times. At the same time, consumption of petrol and compressed gas increased by 3.6 times.

As of 1 January 2023, 13 private carriers and the Lutsk Electric Transport Enterprise provided public transport services. Private carriers operate 28 routes. Their fleet consisted of 139 buses. The total length of bus routes is 330 km. The average length of a trolleybus route is 21.29 km [9].

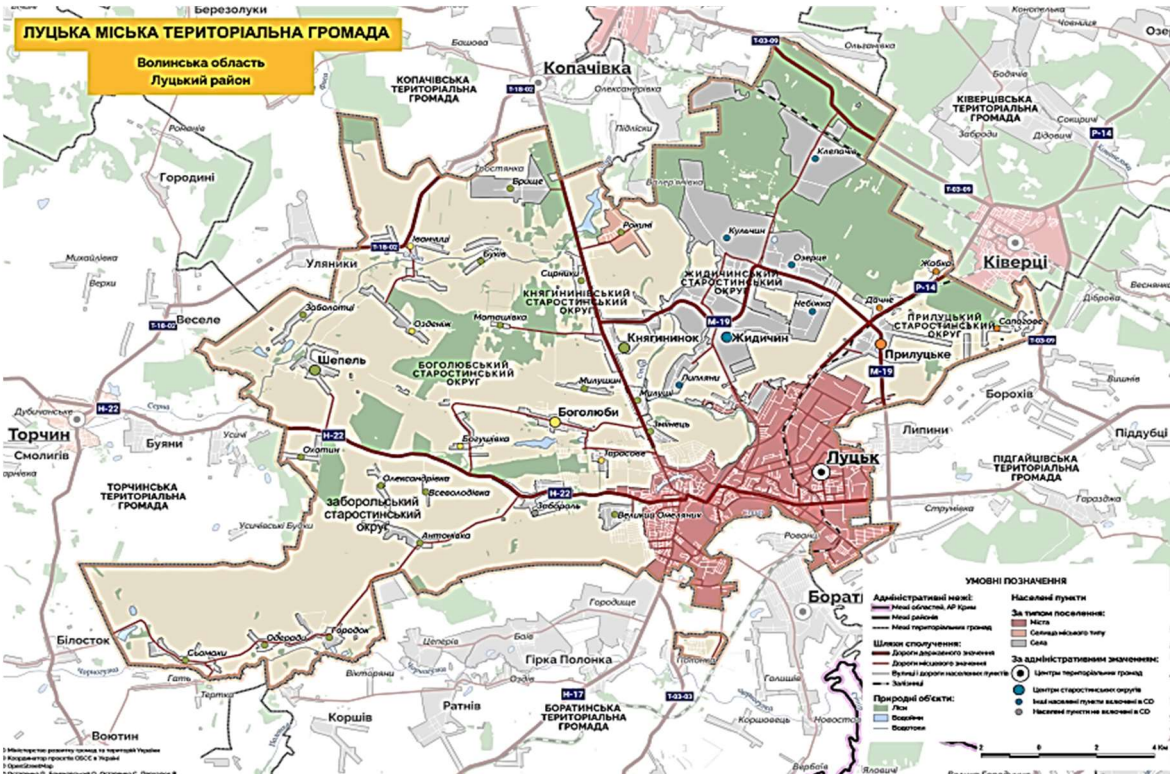

Fig. 1. Map of Lutsk city territorial community [10].

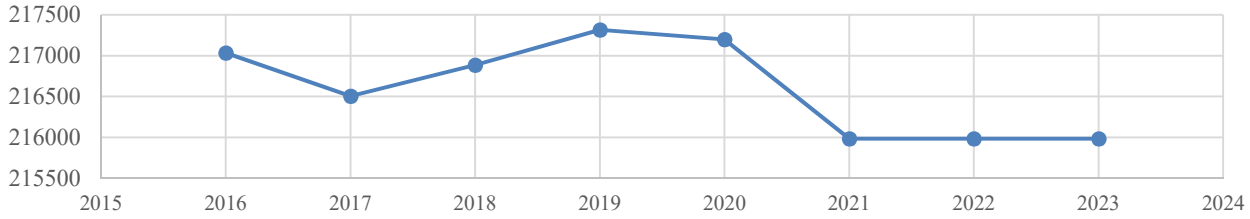

Fig. 2. Dynamics of the population of Lutsk, people. [10]

Table 1

Characteristics of municipal transport of Lutsk city territorial community [9]

Cars		Freight vehicles		Buses		Special transport	
Number	Average year of production	Number	Average year of production	Number	Average year of production	Number	Average year of production
132	2003	89	1997	32	2002	169	1997

Table 2

Fuel consumption by municipal transport in 2022 [9]

Fuel	Gasoline	Diesel fuel	Liquefied gas	Compressed gas
Units of measurement	Litres	Litres	litres	m^3
Number	364066,01	725032,21	74959,33	28199,04

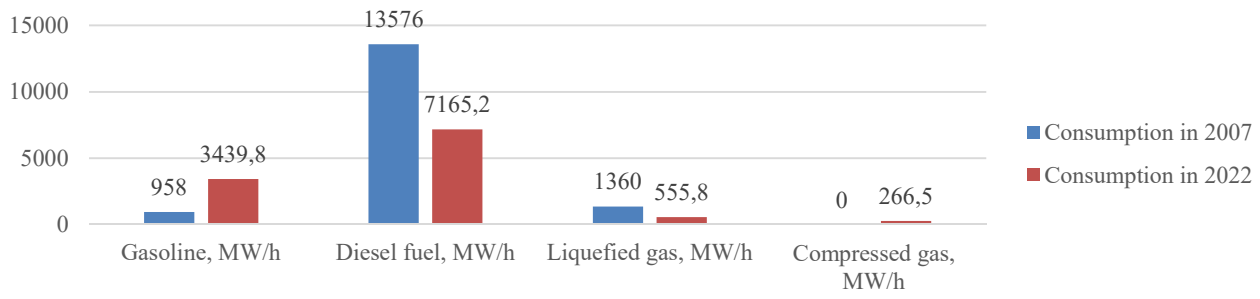

Fig. 3. Total fuel consumption by municipal transport in Lutsk in MW/h [9].

Table 3

Public transport in Lutsk city territorial community [9]

Indicator	2015	2022
Number of carriers	10	13
including trolleybuses	1	1
Number of routes	39	30
including trolleybuses	11	9
Total number of vehicles used by carriers	298	212
including trolleybuses	65	73
Total length of the contact network for trolleybuses, km	109,2	109,2
Number of traction substations for trolleybuses	9	9
Operational length of trolleybus lines, km	276	276

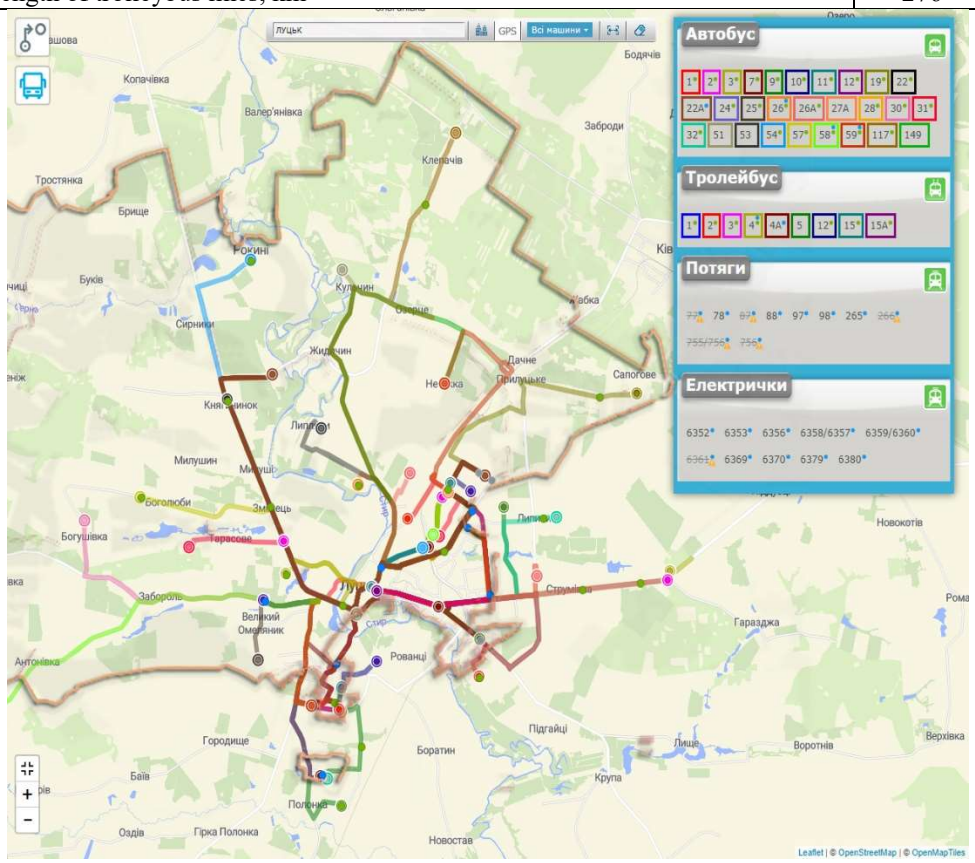

Fig. 4. Scheme of public transport movement in Lutsk city territorial community [9].

There are 717 public transport stops within the community. 454 stops are located in Lutsk (Table 3, Fig. 4). Since 2019, an automated fare collection system has been implemented, which also includes GPS monitoring, automatic passenger notification and video surveillance. Various interfaces and a mobile application are available for users. As part of the project "Use of environmentally friendly and smart technologies in the public transport system of Lutsk", new smart stops with information boards, solar panels, phone charging points, Wi-Fi and other amenities were installed. A special website with information about the city's public transport has been created [9]. In 2022, compared to 2015, the number of carriers and trolleybuses increased, the number of routes decreased (from 39 to 30), and the number of vehicles used by carriers decreased (from 298 to 212).

The fuel consumption of public transport is calculated based on the kilometres travelled and the characteristics of the vehicles. Fuel consumption data for the period 2007-22 is shown in Table 4.

During 2007-22, fuel consumption was gradually reduced by increasing the use of trolleybuses in the city's public transport.

However, in the Lutsk city territorial community, over the past few decades, the number of vehicles has increased significantly, causing congestion on the city streets, increased air pollution, and deteriorating living conditions for the citizens.

According to the regional service centre of the MIA's CMC in Volyn Oblast, passenger cars account for the largest share of private motor vehicles in the Lutsk city territorial community -

85% [9].

Table 4

Fuel consumption by public transport in Lutsk, MW/h [9].

Types of fuel	Fuel consumption by years MW/h			Consumption in 2022 compared to 2007 p (%)
	2007	2020	2022	
Electricity	8944,878	5272,809	4680,113	52
Diesel fuel	38476,3	23596,8	22351,4	58
Total	47421,178	28869,609	27031,513	57

Table 5

Total fuel consumption by private and commercial transport in 2007 and 2020 (MW/h) [9].

Years	Fuel consumption by years MW/h					Total fuel consumption, MW/h
	Electricity	Gasoline	Diesel fuel	Liquefied gas	Compressed gas	
2007	-	100979,43	118887,19	9979,45	159390,00	389236,07
2020	833,792	87795,19	101463,80	8912,19	237456,60	436461,57

Table 5 shows that electricity consumption increased by 100% in 2020 compared to 2007. This is due to the emergence of electric cars and the infrastructure for them. Petrol consumption decreased by 11%, diesel fuel – by 17%, liquefied gas consumption – by 12%, while compressed gas consumption increased by almost 1.5 times. The difference between 2007 and 2020 is explained by the fact that the share of electricity and compressed gas vehicles in the Lutsk community is increasing. Total fuel consumption increased by 12.1%. This correlates with the all-Ukrainian data on the growth of the number of vehicles in the specified time frame.

This situation with the development of transport in the community causes environmental problems to become more acute. First of all, within the city of Lutsk. They include air pollution, noise pollution, impact on green areas and biodiversity.

The article by V.O. Fesiuk and I.A. Moroz [12] analyses in detail the state of air pollution in Lutsk. They found that Lutsk is regularly included in the list of Ukrainian cities with the highest level of air pollution (Fig. 5). From 2009 to the present day, the value of the city's air pollution index has varied between 7.7 and 10.49. This corresponds to a high level of pollution (according to the methodology of the Borys Sreznevsky Central Geophysical Observatory). Lutsk's place in the list (rating) of the most polluted cities in Ukraine correlates with the value of the air pollution index. In 2013-14, the index value was relatively low (7.99-8.55), and the city was ranked 22nd in the rating. In 2016, the index value for the city began to increase, which corresponded to the 9th-7th place in the ranking.

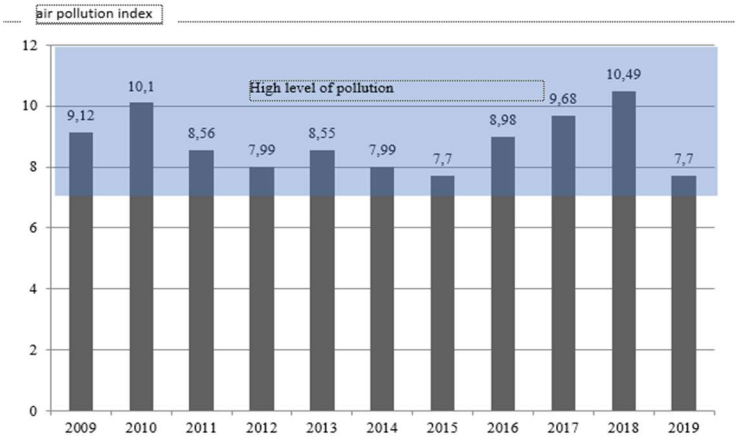

Fig. 5. Dynamics of the atmospheric pollution index in Lutsk (according to the Borys Sreznevsky Central Geophysical Observatory) [12]

As can be seen from Fig. 6, the content of NO_2 in the city air is constantly exceeded by 2-2.6 times, phenol by 1.2-1.8 times, and formaldehyde by 1.9-3.1 times. The presence of these substances in the city's air indicates significant transport pollution. The concentration of other substances, as a rule, does not exceed the maximum permissible concentration. The air quality in the city is significantly affected by the production activities of 44 enterprises and organisations of the city, as well as the operation of boiler equipment that runs on organic fuel.

The impact of transport on ecosystems is the pollution of the atmosphere, water bodies and land, changes in the chemical composition of soils and microflora, and the generation of industrial waste, sludge, boiler slag, ash and garbage [7].

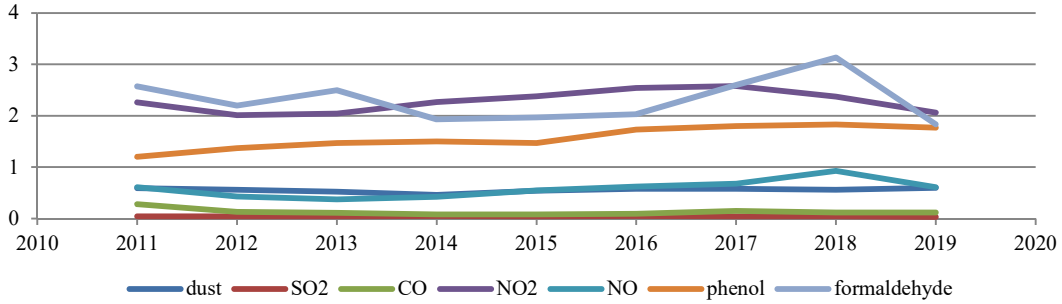

Fig. 6. Multiplicity of exceeding the MPC (daily average) for pollutants in in the atmospheric air of Lutsk (based on the materials of the Volyn DHM) [12]

Pollutants, in addition to their harmful effects on wildlife, have a negative impact on man-made systems, especially on building materials, historical, architectural and sculptural monuments, and cause corrosion of metals and damage to leather and textile products. Transport operation results in increased consumption of natural resources, including atmospheric air required for internal combustion engines, oil products and natural gas used as fuel for engines, water for engine cooling and vehicle washing systems, production and domestic needs of transport companies, and land alienated for the construction of roads, railways and other transport infrastructure. In addition, the operation of internal combustion engines and fuel-burning plants generates heat, high levels of noise and vibration. The biggest problem of the urban transport complex is the lack of complete ring (bypass) roads covering the city, poor road surface condition, congestion of some streets due to low capacity and irrational structure of traffic flows [11].

Noise pollution in the city also exceeds the permissible values. In Lutsk, it is caused mainly by motor vehicles. The maximum permissible level of noise pollution in cities is 70 dB. This standard is exceeded for almost the entire city. Significant noise pollution is typical for streets with heavy traffic [11]. Most of them are located in the city centre (Vynnychenko, Hlushetz, Volia Avenue) – 84-90 dB, or on the outskirts of the city and bypass routes (Kovelska, Volodymyrska, Kivertsivska, Rivnenska, Dubnivska, Lvivska streets) – 80-84 dB. The problem of noise pollution in the city has been relevant since the 70s of the twentieth century. Today, the car fleet is growing, and the problem is getting worse.

Road transport in cities also has a significant impact on green areas and biodiversity. This is due to the absorption by plants of harmful substances contained in vehicle emissions, noise and vibration, and the development of urban transport infrastructure. Paper [7] presents the results of an assessment of the accumulation of heavy metals in tree branches within the city of Lutsk. Lutsk (Fig. 7).

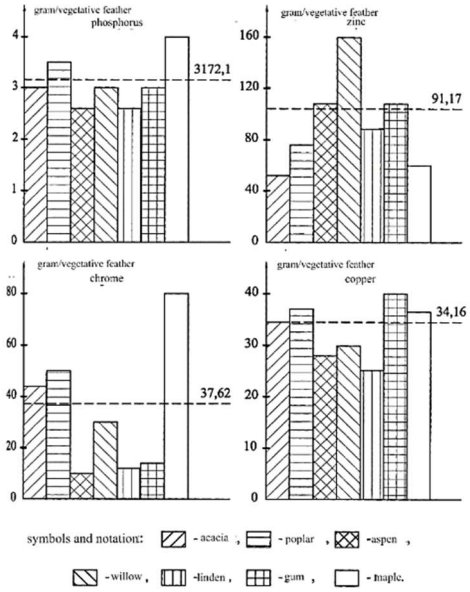

Fig. 7. Histograms of pollutant content in tree branches in Lutsk [7]

The research was conducted on plants with shallow root systems. Birch, alder, maple, poplar, willow and other trees are the most informative for environmental studies. The highest concentration of pollutants is found in the branches. In work [7], the following were studied: poplar - more than 50 samples, acacia - 15, aspen - 15, willow - 30, linden - 15, ash - 8, maple - 15. The average content of elements in plants is presented in histograms (Fig. 7). Different plant species have different capacities for absorbing and accumulating heavy metals and other chemical compounds. The average coefficients of biological absorption of toxic elements by vegetation ($K_б$) relative to the background content were calculated: phosphorus - 6.9; zinc - 4.2; chromium - 2.9; copper - 2.6; strontium - 11.1; lead - 3.2. Long-term air pollution affects the colour of leaves, the time of their fall, the shape of growth and microscopic changes in plants. Coniferous species (spruce, pine, larch, etc.) are the most sensitive to various air pollutants. The most resistant to air pollution are white acacia, poplar and narrow-leaved sucker. Spruce, juniper, and pine are resistant to toxic gases, and alder, hazel, viburnum, rowan, and dogwood are dust collectors [7].

The research allowed us to make certain generalisations. For this purpose, the transport and environmental sustainability index of the city of Lutsk was calculated – a comprehensive indicator that assesses the efficiency and environmental friendliness of the city's transport system. It takes into account various aspects of the interaction between transport and the environment, as well as the impact on the quality of life of residents. The components of the index are as follows [13]:

1. Air quality (level of CO_2 and NO_x emissions from transport, concentration of fine particles (PM2.5, PM10)).
2. Noise pollution (average noise level from transport, percentage of the population exposed to excessive noise).
3. Public transport efficiency (public transport network coverage, frequency of service).
4. Development of bicycle infrastructure (length of bicycle paths per km² of the city territory, number of bicycle parking spaces, percentage of trips made by bicycle).
5. Walkability accessibility (walkability index, area of walkability zones).
6. Energy efficiency (percentage of environmentally friendly transport, energy efficiency of public transport).
7. Management of parking space (ratio of parking spaces to the number of cars, availability of the Park and Ride system).
8. Innovation and adaptability (introduction of intelligent transport management systems, flexibility of the transport system to crisis situations).

Table 6

Calculation of the transport and environmental sustainability index of the city of Lutsk

№	Index component	Indicator	Score, points	Commentary
1.	Air quality	CO_2 and NO_x emissions	1	High
		Concentration of fine particles	3	Medium
2.	Noise pollution	Noise level	1	High
		Percentage of population exposed to excessive noise	2	100%
3.	Efficiency of public transport	Public transport network coverage, frequency of service	2	Coverage - 80%, frequency of service is insufficient
		Average travel time	3	Medium (30 min.)
4.	Development of bicycle infrastructure	Length of bicycle lanes per km² of territory	2	Low
		Number of bicycle parking lots	2	Low
		Percentage of trips made by bicycle	2	Low
5.	Walkability	Walkability index	3	Medium
		Area of walkable zones	2	Insufficient
6.	Energy efficiency	Percentage of environmentally friendly transport	4	Constantly increasing
		Energy efficiency of public transport	4	Significantly improved in recent years
7.	Parking space management	Availability of parking spaces	1	Critically insufficient
		Availability of "Park and Ride" system	1	Absent
8.	Innovation and adaptability	Implementation of intelligent transport management systems	4	Significantly increased in recent years
		Flexibility of the transport system to crisis situations	3	Medium
Transport and environmental sustainability index of the city (max. 85 points)			40	Medium

The index is calculated as follows: each component is rated on a scale from 1 to 5, with 5 being the best score. The overall index is calculated as a weighted average of all components, where the

weights are determined by experts taking into account the specifics of a particular city. The maximum value of the index is 85 points. The transport and environmental sustainability index is applied to:

- monitoring the city's progress in improving the transport and environmental situation;
- comparing different cities (different city districts) and identifying best practices;
- identifying priority areas for investment and development;
- informing the public about the state of the transport system and its impact on environmental safety.

The city's transport and environmental sustainability index is 40 points. This indicator is below the average value. No similar studies have been conducted for other cities. Therefore, there is no possibility of comparison with other cities. In this context, it is important for the local authorities to reduce air pollution and noise levels, increase the frequency of public transport, develop bicycle infrastructure, pedestrian accessibility and the parking system, and start implementing the Park and Ride approach.

To improve the environmental safety of transport in Lutsk, it is necessary to carry out:

1. Development of cycling infrastructure that will improve the city's environmental condition, public health, and reduce traffic congestion. Specific steps for the city of Lutsk: creating a network of bicycle paths connecting residential areas with the city centre and places of work, installing safe bicycle parking near public facilities and transport hubs, and creating a city bicycle rental system.

2. Wider introduction of electric transport, which will help reduce emissions, noise pollution and energy efficiency. Specific steps for Lutsk: gradual replacement of city buses with electric buses, development of a network of charging stations for electric vehicles, introduction of benefits for electric vehicle owners (free parking, separate lanes).

3. Optimisation of the public transport system means increasing the efficiency of transportation, as public transport carries more passengers using fewer resources. Its development helps to reduce congestion and improve mobility for all segments of the population. Specific steps for Lutsk: analysis and optimisation of public transport routes for better coverage of the city, reduction of transport intervals, and renewal of rolling stock to more environmentally friendly and comfortable models.

4. Wider introduction of intelligent transport systems that reduce congestion and vehicle downtime, provide passengers with up-to-date information on traffic, and monitor and collect data to further improve the transport system. Specific steps for Lutsk: introducing an adaptive traffic light control system, increasing the number of smart stops with information boards.

The proposed measures can significantly improve the environmental situation, increase the efficiency of the transport system and the quality of life of the city's residents.

Conclusions and prospects for using the research results. Based on the theoretical and empirical material analysed in the article, we conclude that it is necessary to develop a strategy for improving the transport and environmental situation in Lutsk. It should include short-term and long-term measures. Short-term measures are aimed at improving the situation quickly and can be implemented within 1-3 years. They include:

1. Optimisation of public transport: review and optimisation of routes, wider introduction of dedicated lanes for public transport, reduction of public transport intervals.

2. Improving walkability infrastructure: repairing sidewalks, installing additional walkability crossings, improving street lighting, improving transport and walkability accessibility of the city for people with limited mobility.

3. Development of bicycle infrastructure: creation of protected bicycle lanes on major highways, bicycle parking near public facilities, and a pilot project of urban bicycle rental.

4. Measures to regulate road traffic: introduction of "smart" traffic lights at key intersections, expansion of pedestrian zones and areas with limited traffic in the city centre, expansion of the number and capacity of car parks, introduction of the "Park and Ride" approach.

5. Environmental initiatives: strengthening control over vehicle emissions, organising car-free days, and encouraging the use of environmentally friendly transport in various ways.

Long-term measures are designed for a period of 5-15 years and are aimed at systemic changes in the city's transport infrastructure.

1. Development of electric transport: gradual replacement of the bus fleet with electric buses, expansion of the trolleybus network and trolleybus fleet, creation of an extensive network of charging stations for electric vehicles.

2. Comprehensive development of bicycle infrastructure: creation of a full-fledged network of bicycle paths covering the entire city, integration of bicycle infrastructure with public transport, introduction of a city bicycle rental system

throughout the city

3. Modernisation of the public transport system: introduction of the BRT (Bus Rapid Transit) system, creation of transport hubs, transition to a single travel document system.

4. Implementation of intelligent transport systems: creation of a unified city transport management centre, adaptive traffic light control, development and implementation of mobile applications for multimodal transport.

5. Urban planning focused on sustainable development: implementation of the "15-minute city" concept, creation of pedestrian zones in the city centre, deeper integration of transport planning with urban planning policy.

6. Stimulating the use of environmentally friendly transport: introducing economic incentives for the use of environmentally friendly transport, creating zero-emission zones in the city centre.

The strategy for improving the transport and environmental situation in Lutsk is aimed at creating a sustainable, environmentally friendly and efficient transport system in Lutsk that will meet the needs of the city's residents and contribute to improving the quality of life.

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Василь ФЕСЮК, Ірина МОРОЗ, Лариса ЧИЖЕВСЬКА, Яна КІЙКО, Артур КАРПУК. ТРАНСПОРТ ТА ЕКОЛОГІЧНА БЕЗПЕКА МІСТ (НА ПРИКЛАДІ ЛУЦЬКОЇ МІСЬКОЇ ТЕРИТОРІАЛЬНОЇ ГРОМАДИ)

В статті досліджуються транспортний комплекс Луцької міської територіальної громади, транспортний парк, транспортна інфраструктура. Громада розташована на південно-східній частині Волинської області, на північному заході України, включає обласний центр та 6 старостинських округів. Чисельність населення Луцької міської територіальної громади становить 244,6 тис. Осіб, м. Луцька – 216 тис. Осіб. Загальна протяжність автомобільних доріг громади із асфальтовим покриттям становить 308,4 км, в т.ч. автомобільних мостів та шляхопроводів – 22 км. Деякі вулиці та проспекти обладнані спеціально позначеними велодоріжками. Загалом рівень впровадження велосипедної інфраструктури в місті Луцьк та громаді потребують поліпшення. Перевезення вантажів та пасажирів здійснюється різними видами транспорту: електричним (тролейбуси), автобусами, легковими та вантажними автомобілями, а також залізницею. Зважаючи на особливості транспортної системи громади, форми власності та обсяги споживання палива, транспорт міста можна розділити на три основні категорії: муніципальний, громадський та приватний. Протягом 2007-22 років поступово зменшувалося споживання палива за рахунок збільшення використання в громадському транспорті міста тролейбусів. Проте в Луцькій міській територіальній громаді протягом останніх кількох десятків років помітно зросла кількість транспорту, що спричинило завантаження вулиць міста транспортом, збільшення забруднення атмосферного повітря, погіршення умов життя містян. Луцьк регулярно потрапляє до переліку міст України із найвищим рівнем забруднення атмосферного повітря. З 2009 р. і до нашого часу величина індексу забруднення атмосфери міста змінюється в межах 7,7-10,49. Це відповідає високому рівню забруднення. В повітрі міста постійно перевищений вміст NO2 в 2-2,6 рази, фенолу в 1,2-1,8 рази, формальдегіду – в 1,9-3,1 рази. Наявність в атмосферному повітрі міста 173амец их речовин свідчить про значне транспортне забруднення. Шумове забруднення міста також перевищує допустимі значення. Для м. Луцька воно спричинене, переважно, автотранспортом. Значне шумове забруднення характерне для вулиць з інтенсивним рухом транспорту. Більшість з них знаходяться в центрі міста (вулиці Винниченка, Глушець, проспект Волі) – 84-90 дБ або на виїзді з міста і об'їзних трасах (вулиці Ковельська, Володимирська, Ківерцівська, Рівненська, Дубнівська, Львівська) – 80-84 дБ. Також автомобільний транспорт у містах чинить значний вплив на зелені зони та біорізноманіття території. Це відбувається внаслідок поглинання рослинами шкідливих речовин, що містяться у викидах автомобільного транспорту, шуму і вібрації, розвитку транспортної інфраструктури міст. Індекс транспортно-екологічної стійкості міста становить 40 балів. Для місцевої влади в цьому контексті важливо зменшувати забруднення атмосферного повітря міста та рівень шуму, збільшувати частоту рейсів громадського транспорту, розвивати велосипедну інфраструктуру, пішохідну доступність і систему паркінгів, почати впроваджувати підхід «Park and Ride». Для поліпшення екологічної безпеки транспорту в Луцьку необхідно: розвивати велосипедну інфраструктуру, ширше впроваджувати електротранспорт, оптимізувати систему громадського транспорту, впроваджувати інтелектуальні транспортні системи. Ці заходи доцільно розділити на короткотермінові та довготермінові. Короткострокові спрямовані на швидке покращення ситуації, можуть бути реалізовані протягом 1-3 років і включають: оптимізацію руху громадського транспорту, покращення пішохідної інфраструктури, розвиток велосипедної інфраструктури, заходи з регулювання автомобільного руху, екологічні ініціативи. Довгострокові заходи розраховані на період 5-15 років, спрямовані на системні зміни в транспортній інфраструктурі міста і включають розвиток електротранспорту, велосипедної інфраструктури, модернізацію системи громадського транспорту, впровадження інтелектуальних транспортних систем, міське планування, орієнтоване на сталий розвиток, глибшу інтеграцію транспортного планування з містобудівною політикою, стимулювання використання екологічно чистого транспорту.

Ключові слова: місто, міська територіальна громада, транспортна інфраструктура, екологічні проблеми, індекс транспортно-екологічної стійкості міста.

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