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**RESEARCH OF EXPEDIENCY OF INTRODUCTION OF BICYCLE
INFRASTRUCTURE IN THE CITIES OF UKRAINE****ДОСЛІДЖЕННЯ ДОЦІЛЬНОСТІ ВПРОВАДЖЕННЯ ВЕЛОСИПЕДНОЇ
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Анотація. В роботі розглядаються питання активного впровадження велосипедного транспорту в містах України, переваги використання велосипеда в якості міського транспорту та пропозиції щодо розвитку велосипедної інфраструктури.

Ключові слова: велосипедна інфраструктура, комфортне пересування, нульове атмосферне та акустичне забруднення, безпека руху.

Abstract. The paper considers the issues of active introduction of bicycle transport in the cities of Ukraine, the advantages of using bicycles as urban transport and proposals for the development of bicycle infrastructure.

Key words: bicycle infrastructure, comfortable movement, zero air and acoustic pollution, traffic safety.

Introduction.

Bicycle is an environmentally friendly vehicle that does not pollute the fresh air with emissions and additionally allows people to physically train their body. Therefore, it is clear that this has received significant support from public transport in recent years and an increase in the number of participants.

Nowadays, the strategy of designing the city's infrastructure based on the principles of sustainable urban mobility has become popular in Ukraine. According to these principles, when designing the city's transport system, more and more attention should be paid to walking and cycling. Namely, the city infrastructure must provide comfortable movement of residents in these ways. Unfortunately, the isolated cycling infrastructure in Ukraine is still something new and not perceived properly. This is mostly due to the lack of education of the city's residents.

Increasing the role of the bicycle in the life of the city contributes to its development. Properly designed and implemented cycling infrastructure has many benefits for both city residents and businesses within it.

Using bicycles as the main type of transport will make cities cleaner and healthier. The bicycle does not emit pollutants into the atmosphere, the noise level from it is zero. Daily use of a bicycle involves exercise. This reduces the risk of



cardiovascular disease and musculoskeletal disorders. All this has a positive effect on the well-being of the city.

Main text.

The development of cycling infrastructure makes cities comfortable, safe to live in and attractive to tourists. Europeans are more likely to find that reducing the number and speed of cars in their city increases the quality of life in it. In places where the speed of cars is reduced to 30 km / h for safe movement in the city, where separate bicycle lanes are allocated, the number of private vehicles is reduced, thus reducing the number and size of traffic jams and time lost in them. According to research, the principle of "safety in quantity" really works: in cities where the majority of the population chooses walking and cycling, the likelihood of accidents is reduced [1].

When using a bicycle, the economic development of the city also increases. Competitiveness is emerging in shopping areas in the city center and within walking distance. After all, cyclists will prefer them, while motorists - large shopping malls located outside of the city. Funds for the cycling infrastructure need to be invested less. And they will, for the most part, be covered by savings on automotive infrastructure. Taking into account the improvement of the health of the residents and the savings on the maintenance of personal transport, the payback of the cycling infrastructure is a maximum of 2.5 years. One parking space for a bicycle costs 95% less than for one car [1]. Moreover, the parking space for one car can accommodate 12 bicycles at a time. This clearly shows how much less space bicycles need to accommodate them.

With the improvement of cycling infrastructure, the tourist attractiveness of the city is also improving. Bicycle for tourists is a convenient and enjoyable way to explore the city. Although it is slower than the bus, at the same time, its speed is comfortable enough to see everything.

According to a study conducted in Italy in 2011, the average speed in cities is 15 km / h and 20 km / h for urban transport and private transport, respectively.

Such a low speed of movement makes bicycle mobility quite competitive on nearby city trips - 5-10 km [2].

There are advantages to using a bicycle as the main type of transport [3]:

- continuous and regular use of bicycle transport increases the amount of daily physical activity;
- reduction of the share of the budget for car maintenance;
- reduction of time lost in traffic jams;
- zero atmospheric and acoustic pollution.

Due to the growth of bicycle mobility in Ukraine and the world, it is necessary to develop road infrastructure to encourage this type of mobility, thereby reducing the number of private motor vehicles on the city's road network. Which in turn will have a good environmental and economic effect. However, as the number of cyclists increases, so does the number of road accidents involving them. Especially at intersections where cyclists are most vulnerable [3].

The specifics of road accidents involving cyclists are the special consequences of physical contact of vehicles belonging to different speed and size groups. In



addition, in the case of a collision, there is a risk of the cyclist falling on the roadway and falling under the wheels of other cars.

Among the typical mechanisms of road accidents involving cyclists are collisions with a cyclist moving on the roadway in the dark. Accidents are also common, caused by a sudden change of lane and direction of traffic in a dense flow of cars due to the appearance of a factor that distracts the cyclist and leads to incidental or counter-contact with motor vehicles. According to the report of the International Traffic Safety Data and Analysis Group (IRTAD) for 2020 [4], the number of deaths among cyclists decreased by 5.4% - the average for 2010 - 2018. However, there is a significant difference between countries in this ranking. Thus, in 42% of countries (13 countries out of 31 for which information is available) the death rate of cyclists in 2018 was higher than in 2010. The largest decreases were recorded in Lithuania (-61%), New Zealand (-50%) and Slovenia (-50%). At the same time, the highest growth occurred in Ireland (80%, but from a very low initial value: from 5 to 9 deaths), the Netherlands (+ 41%), Norway (+ 40%) and the United States (+ 38%) (Fig. 1).

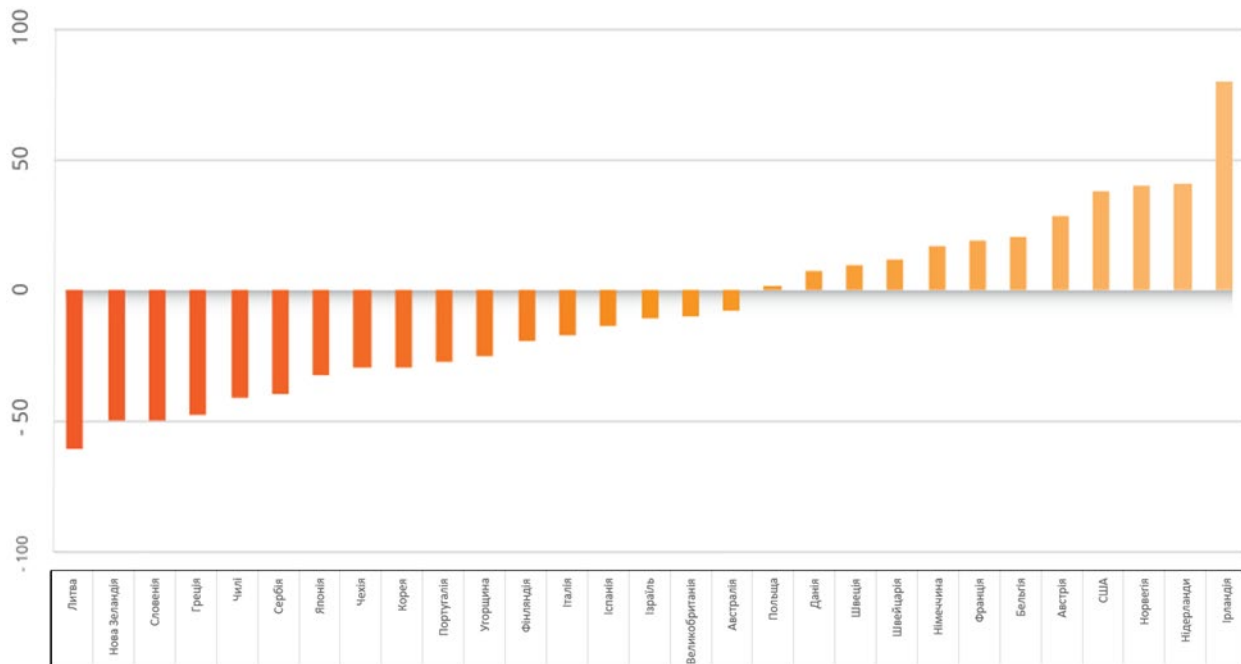


Figure 1 - Change in the percentage of deaths of cyclists in the world for 2010-2018

Source: [4]

Research of statistics of road accidents on the roads of Ukraine for 2011-2020 [5], related to collisions with cyclists, indicates that in the last 3 years, unfortunately, there has been an increase in the number of accidents with injuries, the number of injured and dead cyclists (Fig. 2).

All this confirms that in Ukraine, against the background of the growing popularity of bicycles as public transport, the infrastructure of the country's cities lags behind the scale of growth in the number of two-wheeled vehicles.

In the cities of Ukraine at present, the financing of the new segment of urban transport is carried out on a final basis: from the beginning, the needs of traditional



modes of urban transport are addressed. Bicycle infrastructure construction projects are financed in small amounts, project implementation deadlines are stretched over time. As a result, the development of cycling infrastructure is delayed, lagging behind the growing popularity of bicycles. Which, unfortunately, leads to an increase in the number of road accidents with cyclists.

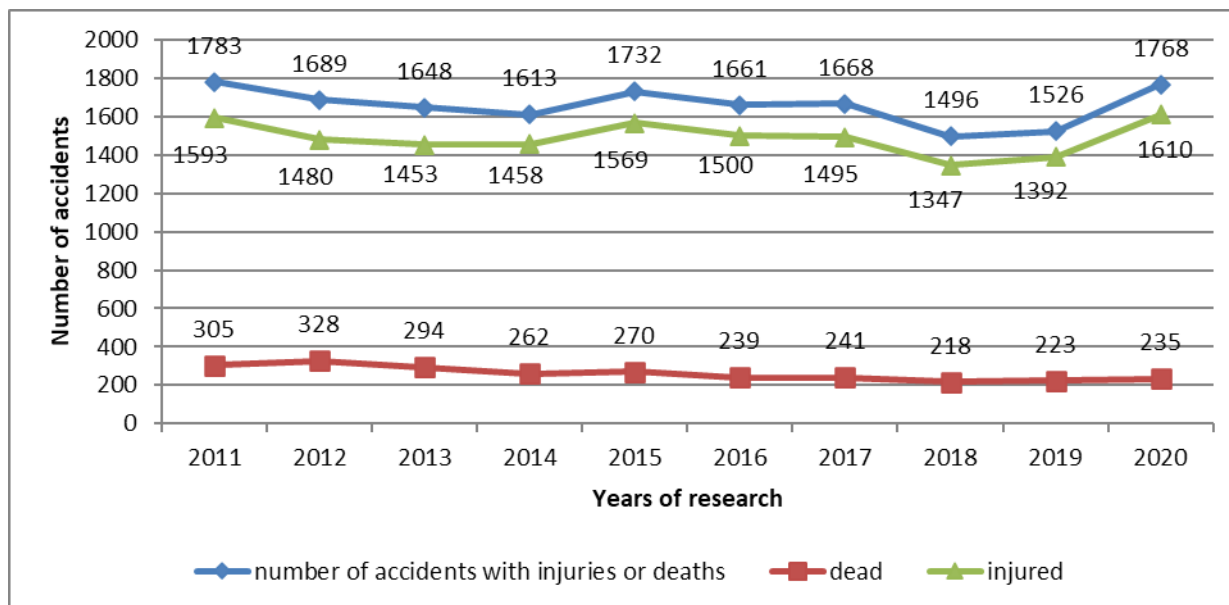


Figure 2 - Statistics of accidents involving cyclists

Source: [5]

Summary and conclusions.

It is proposed to plan to increase funding for the development of cycling infrastructure, namely:

- intensify the construction of bicycle paths;
- build bicycle crossings at intersections;
- build adjacent pedestrian and bicycle lanes and crossings.

After analyzing the data, we conclude that to ensure the safe and comfortable movement of cyclists and pedestrians, it is necessary to conduct awareness campaigns and very carefully approach the design of bicycle paths, taking into account the intensity of pedestrian traffic. Also, pay special attention to the technical means of traffic organization, so that pedestrians on an intuitive level do not want to go on the bike path.

Therefore, to improve the safety of cyclists, cycling infrastructure must be implemented in accordance with certain requirements [3]:

- geometric characteristics should ensure the comfort and safety of users (for example, minimizing the longitudinal slope where possible);
- minimization of points of conflict with other road users;
- ensuring the continuity of bicycle paths;
- signs and markings must be correct and clear to ensure regular and safe driving conditions;
- the roads must be functional and safe - with a proper condition of the road surface.



It is necessary to develop and support the spread of bicycle mobility. To address the growing number of cyclists on the city's road network, you need to take the right approach to planning your cycling infrastructure. It is not enough to just build new bike paths. The entire bicycle network of the city must be continuous with appropriate signs to indicate its clear boundaries. It is necessary to teach the correct behavior of both drivers and pedestrians and cyclists, to conduct awareness campaigns on the introduction of bicycle traffic in cities.

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