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## IMPROVING CYCLIST SAFETY: EXPERIENCE FROM EU COUNTRIES

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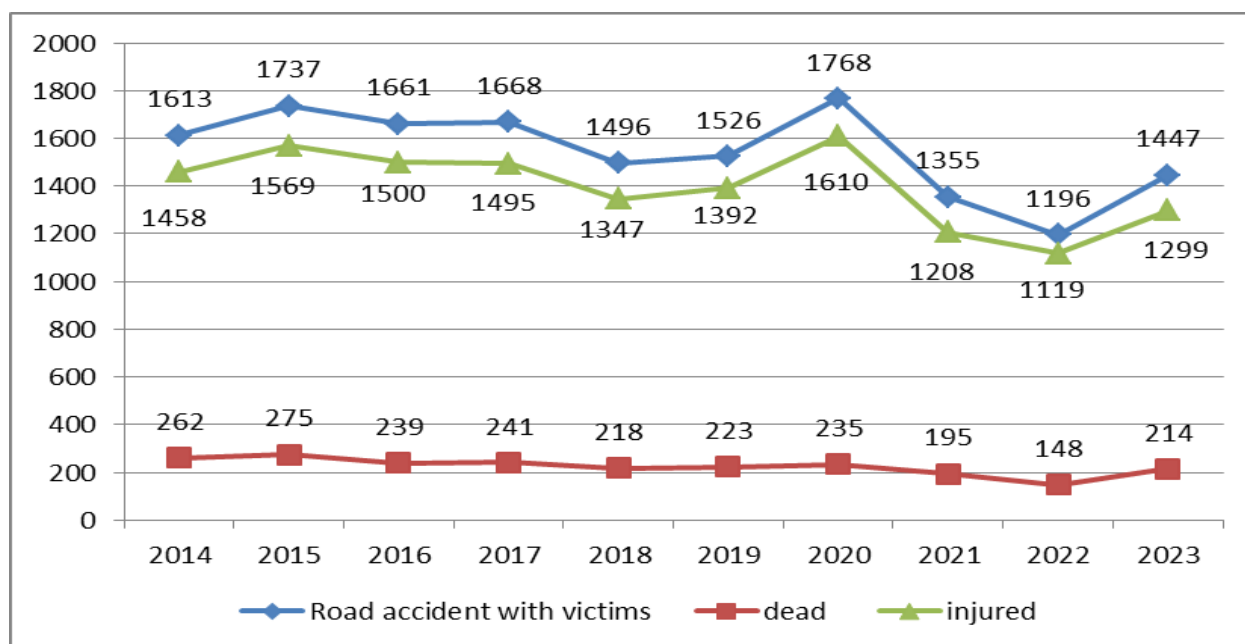
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**Abstract.** The work examines the current state of accidents related to collisions with cyclists, the issue of improving the safety of cyclists, analyzes measures and the experience of their implementation in the EU countries.

**Key words:** cyclist, safety of cyclists, measures aimed at increasing the protection of cyclists while driving.

**Introduction.** The increasing popularity of bicycles as transportation is evident in many countries worldwide, including Ukraine. Bicycles are an environmentally friendly type of transport, causing no harm to the air with emissions and allowing cyclists to maintain good physical fitness by exercising during bike rides. All the mentioned advantages of bicycles as urban transportation have led to a steady increase in their number of enthusiasts, consequently resulting in a growing number of cyclists on roads and city streets in Ukraine.



**Figure 1 – Statistics of Road Traffic Accidents Involving Collisions with Cyclists**

A source: [1]



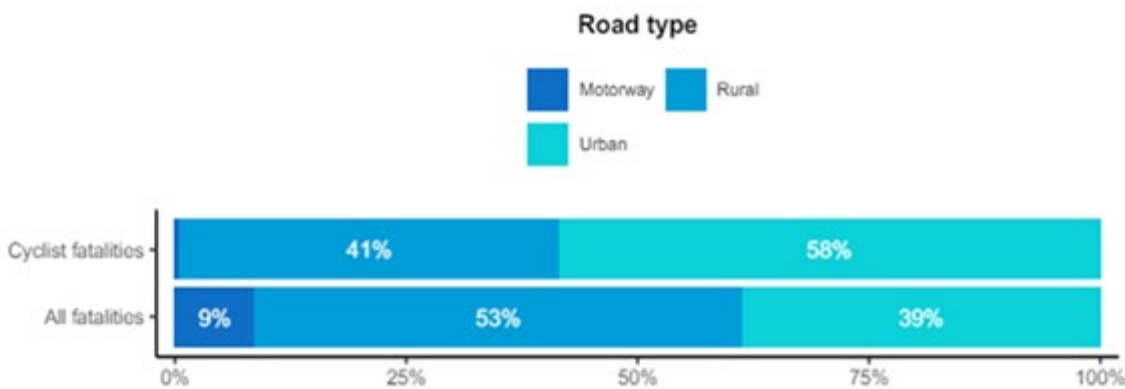
The growing number of cyclists on the roads emphasizes the importance of enhancing their safety. However, an analysis of the statistics of road traffic accidents involving collisions with cyclists on Ukrainian roads from 2014 to 2023 (Figure. 1) shows that the measures implemented in our country to protect cyclists are inadequate [1].

To implement effective measures aimed at improving the safety of cyclists, it is proposed to analyze the experience of European Union (EU) countries in matters of cyclist protection.

**Main text.**

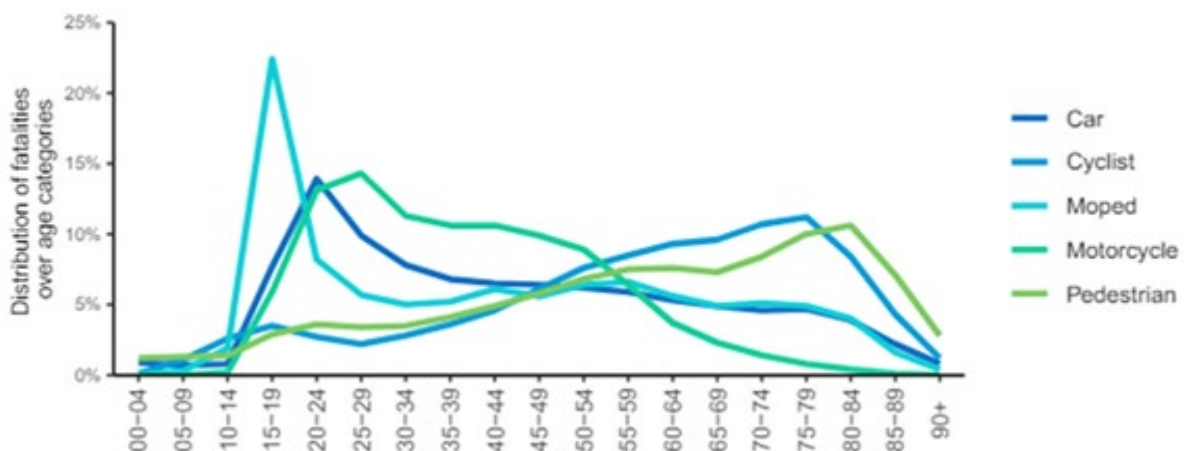
According to the European Road Safety Observatory, since 2010, the annual number of cyclist deaths in the EU has ranged from 1900 to 2100 [2]. In the United States, this number has steadily increased from approximately 873 in 2011 to 1260 in 2020, but it is still significantly lower than in the EU. Thus, in the EU, there are almost twice as many cyclist deaths per year as in the US. However, the EU does not have twice the population of the US - 447.7 million inhabitants in the EU compared to 329.1 million in the US [3].

For example, in 2019, 2035 cyclists died on EU roads, accounting for 9% of all deaths resulting from road traffic accidents (Figure. 2, 3).



**Figure 2 - Distribution by road types in the EU**

A source: [2]



**Figure 3 –Distribution of fatalities over 5-year age categories, by transport mode, In the EU27 (2010-2019)**

A source: [2]



In EU countries, a number of measures are implemented aimed at ensuring the safety of cyclists, taking into account infrastructure, legal norms, and driving culture. Let's consider the experience of EU countries in improving the safety of cyclists.

The European Union has taken a significant position in supporting cyclists, recognizing cycling as a healthy mode of transport that requires more investment. The European Declaration on Cycling encourages authorities in EU countries to prioritize improving connectivity for cyclists in public transport, enhance rules regarding bicycles, and increase investments in this sector [4]. To unlock all the potential of cycling in the EU, the Declaration calls on national, regional, and local authorities to take action. Among the proposed initiatives are positive incentives for commuting by bicycle, creating bicycle parking spaces, and promoting electric bicycles. Additionally, the European Commission, the European Parliament, and the European Council are committed to improving infrastructure to ensure the safety of cyclists on roads and to create dedicated cycling networks in cities.

The Declaration also emphasizes the importance of accommodating the charging needs for electric bicycles in urban planning, meeting the demand for charging stations. Additionally, it urges the European industry to increase the production of electric and conventional bicycles.

### ***Infrastructure for Cyclists***

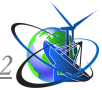
One of the key aspects of improving cyclist safety is the presence of adequate infrastructure. In EU countries, there is a well-developed network of bike lanes, bike rentals, and bike parking facilities. For example, in the Netherlands and Denmark, bicycles are considered one of the most popular forms of transportation, so there are large networks of bike lanes, often separated from roads by special curbs or physical barriers. This allows cyclists to travel safely without conflicting with motor traffic [5].

Several requirements regarding the quality of bicycle infrastructure can also be mentioned:

**1) Safety.** Safety is undoubtedly a fundamental requirement and should be a determining factor. Cyclists pose almost no threat to others, but they themselves feel vulnerable when sharing the road with motorized traffic. The risk arises from significant differences in mass and speed. Safety can be ensured through three measures: reducing traffic intensity and lowering speeds to 30 km/h makes mixed use safe; separating cyclists in time and space from fast and heavy vehicles reduces the number of dangerous collisions; where conflict between cyclists and motor traffic is unavoidable (at intersections), all road users should be warned of the risk and make appropriate changes to their behavior.

**2) Routing.** Routing means that a cyclist can choose the most direct route to their destination as much as possible. Detours should be as short as possible, and the overall travel time for the cyclist should be minimal. This makes cycling competitive for short distances, as the travel time is generally less than that of driving a car. Numerous factors affect this time: detours, the number of intersections, traffic lights, inclines, etc.

**3) Connectivity.** Connectivity refers to how well a cyclist can travel from any departure point to any destination without obstacles. This means that cyclists will



greatly appreciate a network that covers an entire area or city. Accident-prone sections and obstacles, as well as unexpectedly ending cycling infrastructure, all significantly reduce the popularity of cycling. Cyclists should be confident that wherever they go, they will find a route with a sufficiently high level of quality. Every building, every office, and every establishment should be accessible by bike and connected to the network. Connectivity also means good integration with other networks, particularly with public transport stops and transfer hubs.

**4) Attractiveness.** Attractiveness means that cycling infrastructure is well integrated into the surrounding environment. This involves issues of perception and aesthetics that can significantly encourage or discourage cyclists. Since perception is highly personal and variable, it's hard to provide general rules here. However, aesthetic perception should receive due attention during planning, as well as later during the analysis of usage and complaints about a specific route. In addition to design and landscape appearance issues, this also includes the factor of real or perceived personal safety, which is particularly important in the evening and at night.

**5) Comfort.** Comfort involves creating pleasant, relaxed, and worry-free conditions for cyclists during bike rides. Physical and mental efforts should be minimized. For a smooth ride, irregular efforts should also be minimized, including frequent stops and starts that cause fatigue. The use of low-quality materials for surfaces and poor maintenance can cause vibrations and bumps, making cycling more challenging, requiring greater attention and physical effort to control the bike and detect obstacles promptly.

#### ***Education and safety campaigns***

Education and safety campaigns for cyclists in EU countries are important components of strategies to reduce accidents and improve conditions for cyclists. These measures aim to foster a culture of safe riding and responsibility among road users. Implementing such programs helps to provide safe conditions for cyclists and increase overall road safety [5].

In many EU countries, cycling education has become an integral part of school programs and road safety initiatives. Special courses are organized for children, where they learn about safe riding rules, emphasizing knowledge and compliance with traffic rules. This includes the proper use of helmets, reflective elements, signaling turns, and correct behavior on the road.

Most EU countries also make efforts to train adult cyclists. For example, in the Netherlands, there is a program called "Veilig Fietsen" (Safe Cycling), which provides free courses for adult cyclists of all levels. Such courses help raise awareness of dangers and teach how to react to them, as well as how to use traffic rules to ensure cyclist safety [6]. For instance, in Germany, there is the "I See Cyclists" campaign, which emphasizes the importance of drivers being attentive to cyclists and teaches safe overtaking rules. Such initiatives contribute to raising awareness among all road users about the importance of cyclist safety.

#### ***Cycling Safety Campaigns in the EU***

Cycling safety campaigns are also actively carried out in EU countries. One such campaign is "Be Visible, Be Safe," implemented in Ireland. This campaign aims to raise awareness among cyclists about the importance of using reflective elements



and proper lighting when cycling at night or in conditions of limited visibility.

Another example is the "Check Before You Get On" campaign in Germany. Within this campaign, cyclists are reminded of the importance of checking the technical condition of their bicycles before each trip to avoid potential accidents [5].

### ***Legislation and traffic rules***

Legislation and traffic rules also play an important role in enhancing the safety of cyclists. In many EU countries, there are specific regulations concerning cyclist safety. Legislation and traffic rules for cyclists in EU countries are designed to ensure their safety and the safety of other road users. They aim to improve conditions for cyclists and regulate their behavior on the road to ensure the safety and comfort of both cyclists and other road users. These rules also promote mutual understanding among all road users and reduce accidents.

Next, let's consider some general principles and rules for cyclists in EU countries.

### ***Compulsory Rules***

**Helmets:** In many EU countries, there is a requirement for children to wear helmets up to a certain age. For example, in Sweden, Spain, and Finland, children up to 15 years old must wear helmets. In the Netherlands, helmets are not mandatory but are recommended.

**Lighting and Reflectors:** Bicycles must be equipped with front and rear lights, as well as reflectors. This is particularly important in the evening and at night when visibility is reduced.

**Signaling:** Cyclists must use signals to indicate their intentions to turn. This can be done by hand signals or by using special signals on the bicycle.

**Traffic Rules:** Cyclists must adhere to traffic rules, such as stopping at traffic lights, observing the requirements when entering from a side road onto a main road, overtaking, and more.

**Road Signs:** It is important to understand the meaning of road signs and markings, which indicate speed limits, distances to other vehicles, bicycle zones, and more.

### ***Special Requirements in Some Countries***

**Netherlands:** Cyclists in the Netherlands have extensive rights on the roads and a large number of bicycle lanes. They have the right to cross pedestrian crossings on their bicycles.

**Germany:** In Germany, cyclists are required to use bike lanes if they are available. If there is no bike lane, they may use the road but must adhere to the rules for motorcyclists.

**Denmark:** In Denmark, cyclists have priority over cars on some roads, particularly on so-called 'bicycle highways'.

### ***Violations of traffic rules and fines***

In many EU countries, violations of traffic rules by cyclists can result in fines similar to those imposed on car drivers. This may include hefty fines for using a mobile phone while cycling, not wearing a helmet (for children), or lacking reflectors and lights at night. [7].

### ***Innovations and Technologies***



In addition to traditional approaches to safety, EU countries actively implement innovative technologies to protect cyclists. Innovations and technologies play an important role in the development of cycling culture and improving road safety in EU countries. Let's consider some of the most well-known innovations and technologies applied for cyclists in the EU.

#### *Electric Bicycles*

Electric bicycles have become increasingly popular in EU countries. They allow for long-distance travel with minimal effort and help cyclists overcome steep inclines or significant distances. This technology contributes to the proliferation of bicycles among the general population and reduces the use of automobiles, resulting in lower CO<sub>2</sub> emissions and improved air quality.

#### *Safety Systems*

Safety systems are being implemented in EU countries to help cyclists avoid accidents and reduce injuries. For example, automatic braking systems for bicycles help prevent collisions or reduce their consequences by automatically braking in critical situations. Other innovations, such as blind spot detection systems and collision warning systems, contribute to the safety of cyclists on the road.

#### *Smartphone Applications*

The development of smartphones and applications creates new opportunities for cyclists. Routing apps allow cyclists to plan optimal routes taking into account distance, road type, and surface. Some apps also provide information about road conditions, traffic, and even hazardous road sections along the cyclist's route.

#### *Electronic Locks and Anti-Theft Systems*

Modern electronic locks and anti-theft systems are used to protect bicycles from theft. Some bicycles in the EU are already equipped with built-in GPS trackers, allowing the owner to track the bike's location in real-time through a mobile app [8].

Innovations and technologies are important for improving conditions for cyclists in European Union countries. They help ensure safety, convenience, and attractiveness of this mode of transportation. The development of electric bicycles, safety systems, smartphone applications, anti-theft systems, and cycling infrastructure contributes to increasing the number of cyclists and fosters the creation of a more environmentally friendly and bicycle-friendly city.

#### **Summary and conclusions.**

Such a comprehensive approach to improving the safety of cyclists in European Union countries not only demonstrates successful practices but also serves as an example for other countries around the world. In the context of increasing interest in active lifestyles, healthy modes of transportation, and reducing environmental impact, cyclist safety becomes even more relevant.

Prevention of accidents, educating drivers about coexistence rules with cyclists, safety technologies, and the development of cycling infrastructure are just part of a wide range of measures aimed at improving cyclist safety.

However, it is important not only to implement these measures but also to maintain constant attention to cyclist safety at the legislative, educational, and infrastructural levels of the country. Reliable government and municipal support and funding are key factors for the successful implementation of these initiatives.



In the future, it is important to continue researching and implementing new technologies that enhance cyclist safety, such as smart safety systems and interactions with vehicles, innovative materials for helmets and protective gear, as well as increasing the efficiency of infrastructure.

Overall, improving cyclist safety on European Union roads reflects not only the importance of this mode of transportation but also demonstrates the positive changes possible through a comprehensive approach and the use of modern technologies. Therefore, implementing measures that have already proven effective in enhancing cyclist safety on EU roads is an opportunity to avoid spending time searching for the most beneficial solutions aimed at improving the comfort and safety of cyclists on roads in Ukraine.

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