

Positive and negative aspects of using personal mobility devices on the road network

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Abstract. The article examines the positive and negative aspects of the use of personal mobility devices on the road network in the Russian Federation in the period from 2018-2023. The advantages of vehicles with an electric motor are analyzed, such as environmental friendliness, comfortable parking conditions, ease of movement over short distances, time saving and physical activity. On the other hand, the study also highlights the risks of traveling on these means, such as accidents, increased risk of injury, lack of safe infrastructure, lack of driving style and seasonality. After studying the statistics of road accidents in which personal mobility devices were involved, problems were identified at the legislative level associated with driving on devices equipped with an electric motor in road cases. In addition, options were proposed to reduce accidents and ensure safe traffic on the road network in the context of the amendments introduced on March 1, 2023, such as increasing the level of awareness regarding traffic safety on road infrastructure, using equipment for certain vehicles and following safety precautions.

1 Introduction

Often, the population increasingly makes a choice towards devices equipped with an electric motor that perfectly covers long distances and is best suited for movement inside the city. Due to such qualities as efficiency, accessibility, energy intensity, environmental friendliness, these tools can reduce the number of vehicles inside the city and reduce traffic intensity. However, there are both positive aspects of using these vehicles and negative ones, having been legally classified as "pedestrians" with significantly higher speed limits than ordinary pedestrians, such road users began to have a negative impact on road safety on sidewalks, road edges, pedestrian zones. Research has shown that the use of SIM on public roads is becoming a serious source of increased danger, both for pedestrians and for persons operating such devices. Due to the fact that these vehicles can develop significant speed, with limited maneuverability, a high probability of loss of control is created.

The purpose of this study was to identify problems associated with the movement of personal mobility devices at the legislative level by studying the positive and negative qualities of electric scooters, electric skateboards, hoverboards and unicycles. Starting in 2017, new means of transportation began to actively appear in the Russian Federation, which,

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in accordance with the amendments made to the traffic regulations of March 1, 2023, we refer to as means of individual mobility. This term means vehicles having one or more wheels (rollers) designed for individual human movement through the use of an engine. It should be noted that these vehicles are quite diverse and in the context of the recent pandemic, they have become the most popular due to a number of advantages: convenient parking and storage conditions, social distancing, savings and ease of use in urban systems due to increased mobility over short distances, but due to the increasing popularity of these vehicles, a problem has arisen related to with an increasing accident rate [1-5].

The rapid increase in personal mobility devices (PMDs) on public roads creates an acute threat of an increase in the number of road accidents involving these vehicles. The danger exists not only for personal mobility devices, but also for pedestrians and vehicle drivers.

However, there are both disadvantages and advantages to using these funds. Personal mobility means are extremely necessary in densely populated cities with dense buildings and have a large number of positive factors: time savings within the city during frequent traffic jams, unhindered parking, ease of use, environmental friendliness, accessibility for all segments of the population [6-20].

A new alternative to using a personal car is the use of a variety of personal vehicles (SIM). SIM is a new era of development in the transport field. The devices began to gain particular popularity in Russia just a few years ago, and in foreign countries they are already actively used as a replacement for a personal car, developing the design and rules of use every year, thereby increasing safety.

2 Materials and methods

Undoubtedly, the main problem associated with SIM and directly affecting the safety and health of the population is the accident rate. However, today there are negative aspects of using these devices in other areas. Let's consider a diagram of the positive and negative aspects of the functioning of mobility aids on the road network.

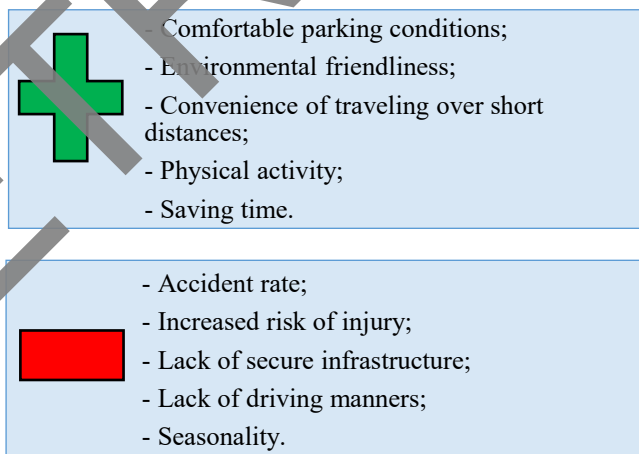


Fig. 1. Scheme of the positive and negative aspects of using personal mobility devices.

In Russian cities, special parking zones have been allocated for personal mobility devices. These are areas on sidewalks, pedestrian paths and streets, near metro stations, public transport stops, and also near shopping centers. Such areas are usually marked with appropriate infrastructure and signs. Personal mobility devices, due to their lightness and

maneuverability, do not require a large parking area, therefore, they can be left in a convenient place for the driver and other road users or pedestrians.

Personal mobility devices such as electric scooters, skateboards, e-skateboards, hoverboards, Segways, unicycles and other similar mobility devices are often considered greener transportation alternatives that run on clean human energy or electricity, meaning they do not produce greenhouse gas emissions in atmosphere. SIMs can use energy from renewable sources such as solar or wind, further reducing their negative impact on the environment.

Modern city traffic offers more and more opportunities for comfortable movement, including new innovative means of individual mobility. SIM, first of all, is convenient for moving over short distances. They are compact in size, easy to use and maneuverable, allowing you to move quickly and efficiently in urban environments or in areas with limited space. They can also be more flexible and affordable travel options, especially when there is no traffic or the need to find parking.

Personal mobility devices, such as bicycles or scooters, provide opportunities for physical activity while moving around the road. Their use requires effort on the part of the user, which helps improve physical fitness and overall health. Cycling, for example, is a great cardio workout that helps strengthen muscles and improve endurance.

The use of SIM can offer savings in travel time, especially in urban environments during rush hour or short distances. They will allow users to avoid traffic congestion and vehicle build-up, which typically results in reaching their destination faster and more efficiently since there is no need to find parking or wait for public transportation.

In order to obtain reliable data on the state of road traffic accidents involving persons traveling on personal mobility devices, information on road accidents contained in the statistics of the Scientific Research Center for Road Traffic Safety, in which the participants were involved, was analyzed. electric scooters, electric skateboards, hoverboards, segways and unicyclesto identify incidents specifically involving SIM. A large number of road traffic accidents involving SIMs occur on the road network, which is associated with certain risks. However, the overall rate of road accidents involving these vehicles depends on various factors, such as compliance with traffic rules, vehicle safety and the attentiveness of road users. It is important to note that the rules of the road apply to all participants, including personal mobility devices. Thus, in 2023, there were 2,647 road accidents involving SIM, of which 25% were hit-and-runs, 32% were collisions, 2,723 were injured and 31 people died.

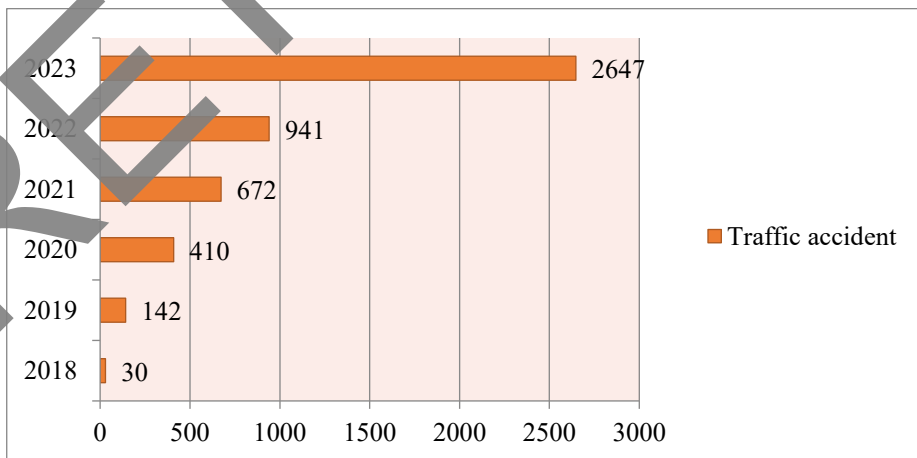


Fig. 2. Indicators of road accidents involving personal mobility devices.

In Russia, the number of road accidents involving personal mobility devices is increasing every year. According to official data on road safety, the number of accidents in 2023 involving SIM in Russia was 2647, which is much more compared to 2022. And if in 2022, 941 road accidents occurred with their participation, in which the number of injured was 976, and the number of dead was 19, then according to statistics for 2023, these figures were exceeded - 2723 (+178.9%) injured and 31 (63.2%) deaths, in 2647 road accidents.

The use of personal mobility devices is accompanied by an increased risk of injury, since owners do not have protection in the event of an accident or damage, unlike motor vehicles. Also, pedestrians, cyclists and owners of other personal mobility devices are more vulnerable on the road and may be more susceptible to injury when colliding with cars or other vehicles. Despite the amendments adopted in 2023 to the Traffic Regulations of the Russian Federation, where clause 1.2 defines that electric scooters and other SIMs now belong to the “vehicle” category, this category still does not exist in the traffic police statistics. SIC STS publishes a fairly detailed analysis of the violations that led to an accident involving SIM.

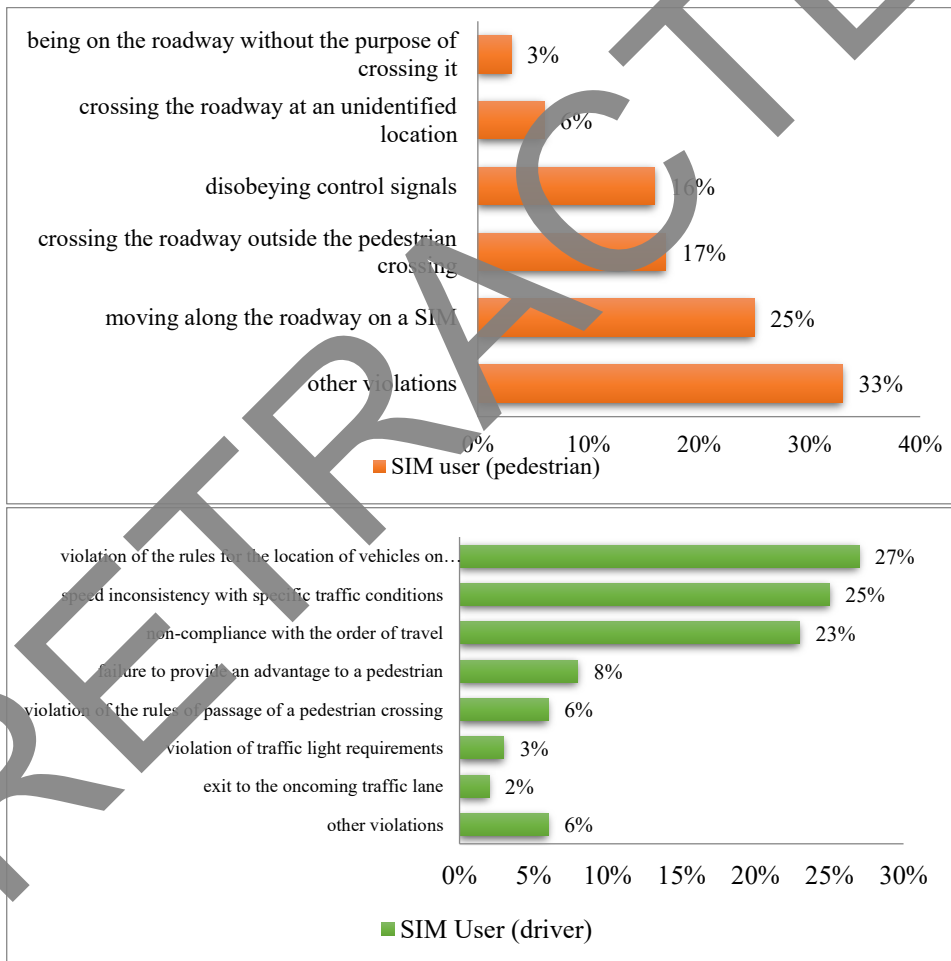


Fig. 3. Types of violations of users of personal mobility equipment.

The lack of safe infrastructure is one of the reasons that entails an increase in road accidents involving personal mobility devices. Thus, the lack of separate paths for cyclists can lead to their sharing traffic with cars, which increases the risk of collisions and accidents,

and the lack of safe pedestrian crossings, an insufficient number of pedestrian islands or parking areas can create danger for pedestrians and cyclists. Also, the lack of sufficient lighting and bright signaling can impede the visibility of users of personal mobility equipment and increase the risk of accidents.

Poor driving habits while using personal mobility devices can lead to dangerous driving situations and an increased risk of accidents. Drivers should not only follow the rules of the road, be careful, give way to other participants, obey the speed limit and not violate safety rules, but also observe the norms of behavior. Safety should be a priority for all road users. Since March 1, 2023, according to the amendments made to the SIM traffic rules (electric scooters, electric skateboards, hoverboards, segways and unicycles), in the absence of pedestrian paths and bicycle paths along with cyclists, they have the right to move along the right edge of the roadway. This creates a great danger, since they do not have a driver's license and equipment (helmet, knee pads).

The seasonality of personal mobility equipment has several disadvantages that the user should take into account. First, some products may be less convenient or unsafe for use in bad weather, cold weather, or snow and ice, and in some regions where winters are cold and snowy, some products may not be available due to lack of infrastructure or inappropriate conditions for their use. Secondly, weather conditions may limit the ability to use personal mobility devices. Rain, snow or strong winds may make travel uncomfortable or unsafe. Third, some SIMs, especially electric ones, may have a limited range per charge, which can be problematic on long trips or in remote areas without charging capabilities.

To resolve the highlighted negative points, it is necessary to refer to the legislation of our country. Let's consider how, from the point of view of managerial power, problems associated with this type of transport are solved, and what has not yet been provided for at the moment.

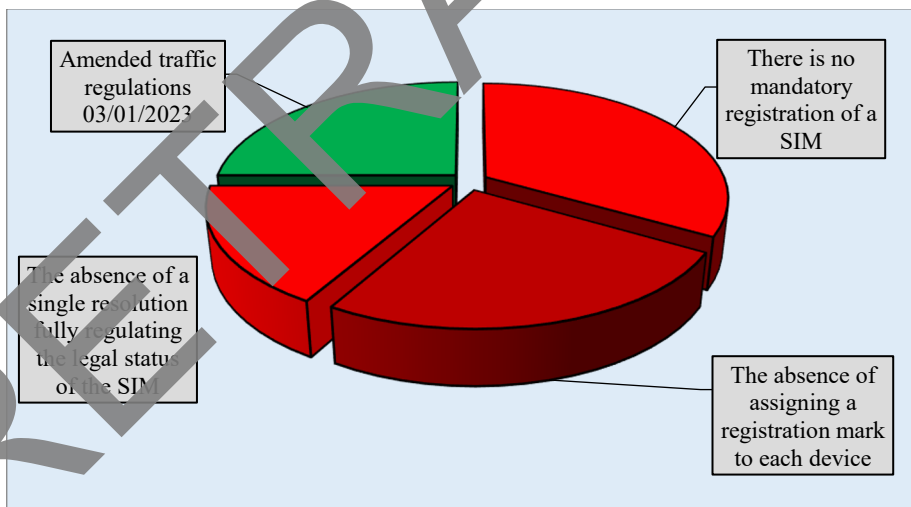


Fig. 4. Problems associated with the movement of personal mobility devices at the legislative level.

Until March 1, 2023, all persons who used personal electric vehicles were treated as pedestrians and their often chaotic movement was not regulated in any way. On March 1, 2023, a decree of the Russian government came into force, which determined legal status of SIMs and their drivers. In accordance with this document, personal mobility devices include electric scooters, electric skateboards, hoverboards, Segways, unicycles and other similar devices. For SIM users, after the amendments, from March 1, 2023, the maximum speed was limited to 25 km/h. Also, all SIMs are equal to vehicles, and no driving license is required.

In Germany there is a system for recording personal mobility equipment. Electric scooters, which became popular in 2019, along with their popularity have multiplied the number of incidents associated with their use and movement on them. The German government responded to this unfavorable situation by issuing a corresponding decree in 2019. According to the adopted document, electric scooters, like other mechanical vehicles driven by low-power electric motors, in Germany began to be classified as small electric vehicles, on which the maximum permitted speed on the roadway, taking into account active safety elements, is 20 km/h.

At the moment, Russia does not have a unified system for recording personal mobility equipment, such as bicycles, scooters or electric scooters. Deputies of the State Duma, after amendments were made on March 1, 2023 to the law “On State Registration of Vehicles in the Russian Federation,” proposed to introduce registration of SIM and obtain registration plates for this equipment. It is assumed that the owner of the SIM will have to register it “through the Unified Portal of State and Municipal Services” within ten days after its acquisition.

In Russia, a registration mark is not assigned to each personal mobility device. However, some cities introduce their own municipal rules and requirements for the use of such funds on public lands. Deputies of the State Duma also propose to introduce a bill in which the owner of a SIM will be required to register a personal mobility device. “After registering a SIM, a state registration number is assigned, its owner is obliged to place on it a state registration mark that meets current standards. If the design of the SIM does not allow this, then the operation of such a device on public roads and pedestrian areas is not allowed,” says the explanatory note to the bill “On State Registration of Vehicles in the Russian Federation.”

3 Results

Research into the positive and negative aspects of using personal mobility vehicles on the road network reveals tensions between improving mobility, saving time and resources, reducing environmental impact and potential threats to road user safety. The high speed and limited maneuverability of such devices increase the risk of accidents on roads involving them, which led to a sharp increase in accidents in 2023 (2647), which is +181.3% compared to 2022, where the number of accidents was 941. Understanding the need The development of safety measures and effective interaction of personal mobile devices with other road users is key. Strict regulatory measures, user safety training, improved infrastructure and awareness campaigns are needed. Only with a balanced approach to the use of these devices can an optimal combination of convenience and safety on the roads be achieved.

Increasing safety awareness, wearing appropriate protective equipment (such as bicycle helmets), and following safety precautions can reduce the risk of accidents involving personal mobility devices. In any case, raising awareness and educating road users about safety when using personal mobile devices are important reduction factors.

4 Discussion

Road users on devices equipped with an electric motor (electric scooters, skateboards, electric skateboards, hoverboards, Segways, unicycles) are classified as “pedestrians” due to recent amendments to the legislation of March 1, 2023. Based on this, for road safety, these means carry an increased risk of accidents, especially on sidewalks, road edges and in pedestrian areas.

According to traffic accident statistics in the Russian Federation, the number of cases involving personal mobility devices increased by 181.3% in 2023 compared to 2022. At the

same time, the number of wounded increased by 178.9% and 63.2% of deaths, which pushes us to take measures to reduce the number of casualties and deaths. Therefore, with the increasing number of users of personal mobile devices on public roads, it is necessary to introduce and establish strict rules and regulations for their use, and ensure the safety of all road users, including drivers.

Effective strategies to increase safety, reduce the frequency of road traffic accidents and reduce the likelihood of accidents are based on the principles of interaction between road users, education of road rules for operators of personal mobility devices, correct adherence to road rules and the development of safe practices for the use of these devices. Ultimately, a balanced approach to the use of personal mobility devices on public roads can lead to improved safety and convenience for all road users.

5 Conclusion

This study raises the current topic of using personal mobile devices in the road network. On the one hand, such devices equipped with an electric motor have a number of advantages, such as increased mobility, efficiency, environmental friendliness and the ability to reduce traffic intensity in cities. However, there are also significant risks and disadvantages. Road users on such devices, classified by law as "pedestrians", may pose an increased risk to road safety, especially on sidewalks, road edges and pedestrian areas.

Given the rapid growth in popularity of personal mobile devices on public roads, there is a need to develop strict regulations and rules for their use, as well as ensure the safety of all road users. When developing regulation and safety measures, it is important to consider both the positive and negative consequences of using such devices. Only a balance between convenience and safety will ensure the effective and safe use of personal mobile devices on the roads.

Effective measures to develop safety, reduce the number of road accidents and reduce the risk of accidents are based on the principles of interaction between road users, training drivers of personal mobile devices to comply with the rules and develop safe practices for using personal mobility devices. Ultimately, a balanced approach to the use of personal mobility devices on the roads will lead to improved safety and convenience for all road users.

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