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Innovative Solution to Reduce Deaths from Road Traffic Accidents

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Annotation: Transport is the basis of modern society; its role is especially noticeable in megacities. But year after year, problems on the world's roads are getting worse. According to the 2006 United Nations Economic Commission for Europe (ECE) report on the 1968 Geneva Convention on Road Signs and Signals, regulations are periodically updated to take into account increasing demands for human safety, environmental protection and rapid technological developments. progress worldwide (UN IEC Report, New York and Geneva, 2007). Unfortunately, for about a hundred years now, no drastic measures have been taken around the world against the causes of road accidents. Our research aims to reduce intersection congestion, traffic accidents and related deaths. A new road sign and traffic light were invented. According to the conclusions of domestic and foreign scientists, the invented sign and traffic light should be a great success in practice.

Keywords: road traffic accidents, violent death, accident, car accident mechanism, car accident situation, a multifunctional traffic light, a multifunctional road sign, a main road, secondary road, a minor road, a pedestrian crossing, intersection center, a traffic light dial, a traffic light flange, lines dividing the main road into two, lines that divide the minor road into two.

Introduction: The development of the global economy, the increase in the number of motor vehicles, the fact that road signs and rules do not fully meet the requirements of the time, as well as the fact that they have not been updated for many years, lead to an increase in road accidents. For these reasons, millions of people die prematurely in car accidents. According to the observations of the World Health Organization, strengthening legislation in the field of preventing road accidents, ensuring its compliance and improving road safety will prevent the premature death of many people and becoming disabled. But due to the fact that such work is not carried out regularly in accordance with the requirements of the time, very annoying accidents occur on the roads [8, 24, 25, 16].

About 1.35 million people around the world die every year in road traffic accidents (RTAs). Every 24 seconds one person loses their life. This is stated in the new Global Road Safety Report 2018, which was released on Friday, December 7, by the World Health Organization (WHO). Approximately 3,700 people die every day in road accidents worldwide. Between 20 and 50 million people every year suffer non-fatal injuries resulting from car accidents. Most of them become temporarily or permanently disabled to one degree or another. Low- and Middle-Income Countries (LMICs) are most affected. The crash death rate is over three times higher in low-income countries than in high-income countries [28].

There were no reductions in the number of crash deaths in any low-income country from 2013 to 2016. LMICs only account for 60 percent of the world's registered vehicles but more than 90 percent of the world's crash deaths. Crash injuries place a major economic burden on LMICs. It is estimated that LMICs will experience approximately $834 billion dollars (in 2010 USD) in economic losses from 2015-2030 due to fatal and nonfatal crash injuries [28].

More than a quarter of all fatalities are pedestrians and cyclists. Traffic accidents at intersections cause premature deaths of pedestrians, cyclists and motorcyclists. Controlling traffic at the intersection will prevent these deaths. The most common fatal accidents involved young people between the ages of five and 40 and children.

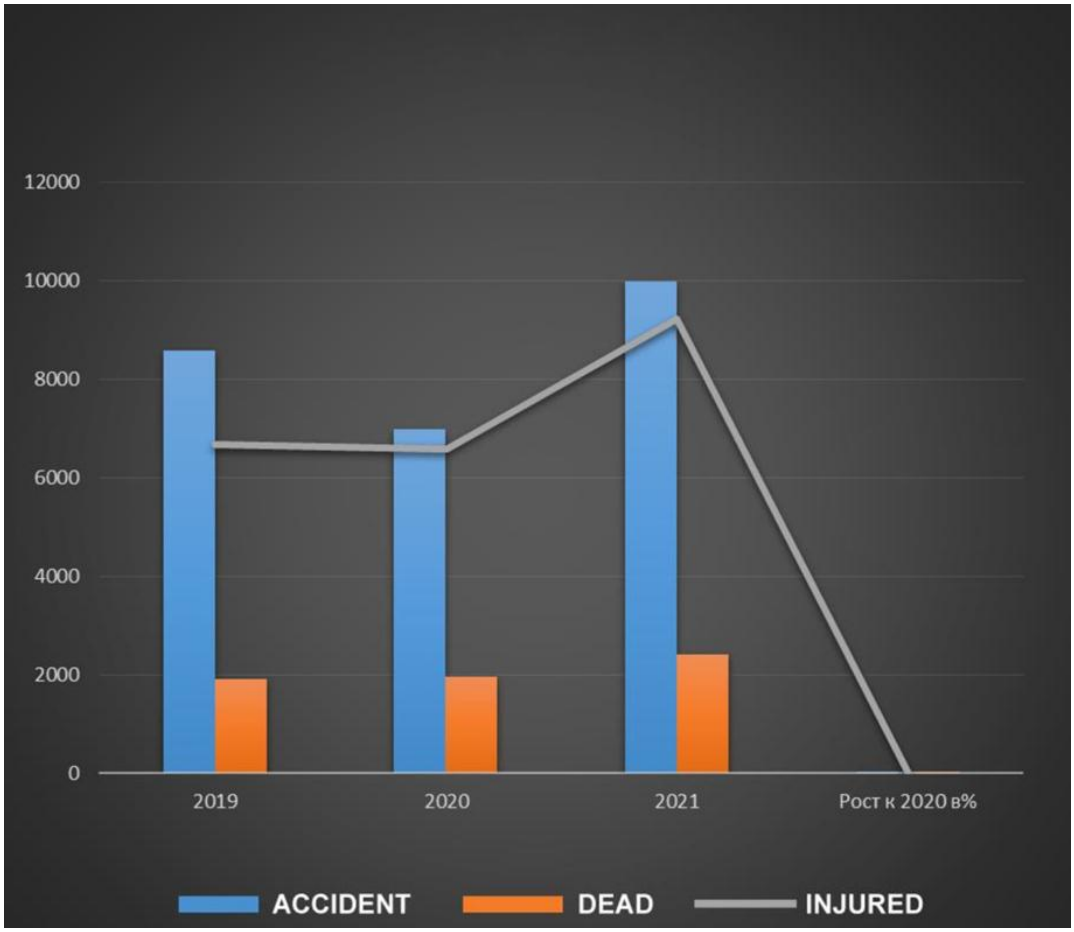
The fact that the average age of those killed and injured is 15-45 years old makes one wonder. The number of road traffic fatalities ranges from 9.3 to 26.6 per 100,000 people worldwide [8].

Some infectious diseases (Ebola, etc.) kill about 10,000 people annually, and car accidents kill about 3,700 or more people a day worldwide [8].

Of the 200,000 U.S. deaths during World War II, 400,000, twice as many, died in automobile accidents on U.S. highways during the same period. There are many such examples [8].

In addition to personal tragedy and enormous human suffering, road traffic accidents cost society an estimated $500 billion a year [17, 24].

The high level of road traffic injuries is directly related to the increase in the number of cars in cities and villages. According to the World Health Organization (WHO), 48,050 people died in road accidents in the United States, 13,904 in Japan, and 12,500 in France. The American Institute of Civil Engineers predicts that there will be 700,000 deaths and 25 million nonfatal accidents involving varying degrees of injury in the United States [17, 24, 25].



Year	2019	2020	2021	Percentage growth by 2020
Accident	8588	6982	10001	43,24%
Dead	1915	1962	2426	23,65%
Injured	6673	6591	9230	40,04%

Fig. 1 Growth of road accidents and their consequences in 2021 year compared to 2020.

According to the Russian State Traffic Inspectorate, the mortality rate in car accidents in 2012 increased by 5.2% compared to 2011. The mortality rate has increased over the past 5 years [9].

Problems on the world's highways are also having a huge impact on the logistics sector [5, 8, 10, 18, 19, 21, 22, 23].

According to the 2006 UN Economic Commission for Europe (ECE) report on the 1968 Geneva Convention on Road Signs and Signals and the Vienna Convention instruments, each member state of the convention has the right to develop and use symbols acceptable to its own country, in addition to the use of recognized symbols. For this reason, some countries (USA, Europe, Australia, etc.) use specific characters. For example, in the USA there are also different road signs [4, 5, 7, 8].

As a result of accidents in Uzbekistan, 2,080 people died in 11 months. Over the 11 months of 2023, 8,693 road accidents occurred in Uzbekistan, in which 2,080 people died and 8,055 were injured. A total of 665 people died as a result of accidents in September, October and November. The Senate committee reported that citizens are the main cause of accidents [27].

For some reason, the Senate commission did not pay attention to the fact that the number of vehicles has increased, the driving culture is low, and road signs and rules do not meet the requirements of the time. In addition, innovations created in the country in the field of road safety are not put into practice, and there are bureaucratic elements in the country's main road safety department.

The issue of road safety has become a pressing issue in our country, as in all countries [1, 2, 3].

Purpose of the study:

The main goal of this study is to regulate road signs and traffic lights, offer modern signs and traffic lights to replace outdated road signs, and reduce the number of car accidents, which very often cause deaths on the world's highways, especially at intersections and in traffic jams at intersections, is aimed at preventing damage to the ecology of the area, as well as preventing poisoning of traffic safety officers controlling traffic at the intersection in the event of traffic jams.

Currently, everyone knows that existing road signs and rules do not meet modern requirements. Experts write about the need for a complete audit in the field of traffic management and road signs [26].

Research results: during the scientific work, road signs and traffic lights were analyzed. Their influence on road users and their role in ensuring road safety have been studied. The study revealed a number of shortcomings. The fact that road signs and traffic lights are not visible to road users from afar, and sometimes even close (due to tall vehicles), makes them more of a hindrance than a help. Such shortcomings are especially noticeable when there is no electricity at the intersection. Due to the large number of vehicles on highways in the modern period of economic development, large traffic jams occur at intersections. To reduce these disadvantages, we were able to invent a multifunctional traffic light and road sign. For this purpose, the Geometric traffic light, Traffic light (variants) and LED traffic lights invented in the Russian Federation were carefully analyzed. [12, 13, 14]. Their shortcomings are revealed. As a result, a more advanced multifunctional traffic light was created from them. Its color scheme corresponds to the protocols of the Geneva Convention [4, 5, 8, 15, 20]

A comparative analysis with the prototypes shows that the invented device differs from the known ones in that the protective screen depicts a road sign in the form of a cross on a blue background, the

center of the cross is painted in a white rectangle, the sides of which are depicted with rectangles with yellow-white stripes, the horizontal line of the cross is painted in green, and the vertical line of the cross is painted red, while on the horizontal and vertical lines of the cross there are also white lines, on the horizontal line of the cross in the area of the rectangles with yellow-white stripes there are four lines of red, followed by white arrows, while these four lines are perpendicular to the white lines and are located diagonally opposite on the horizontal line of the cross, on the vertical line of the cross in the area of the rectangles with yellow-white stripes there are four green lines, behind which there are white arrows, and these four lines are perpendicular white lines and located diagonally opposite on the vertical line of the cross, the color indicator elements are made in the form of LEDs, the control unit is made in the form of a microcontroller, which is electrically connected to the buttons for selecting the traffic light operation algorithm. These distinctive features allow us to draw a conclusion about the novelty of the technical solution.

Thus, the proposed device is novel and can be widely used in controlling traffic at intersections.

The design of the new traffic light is as follows:

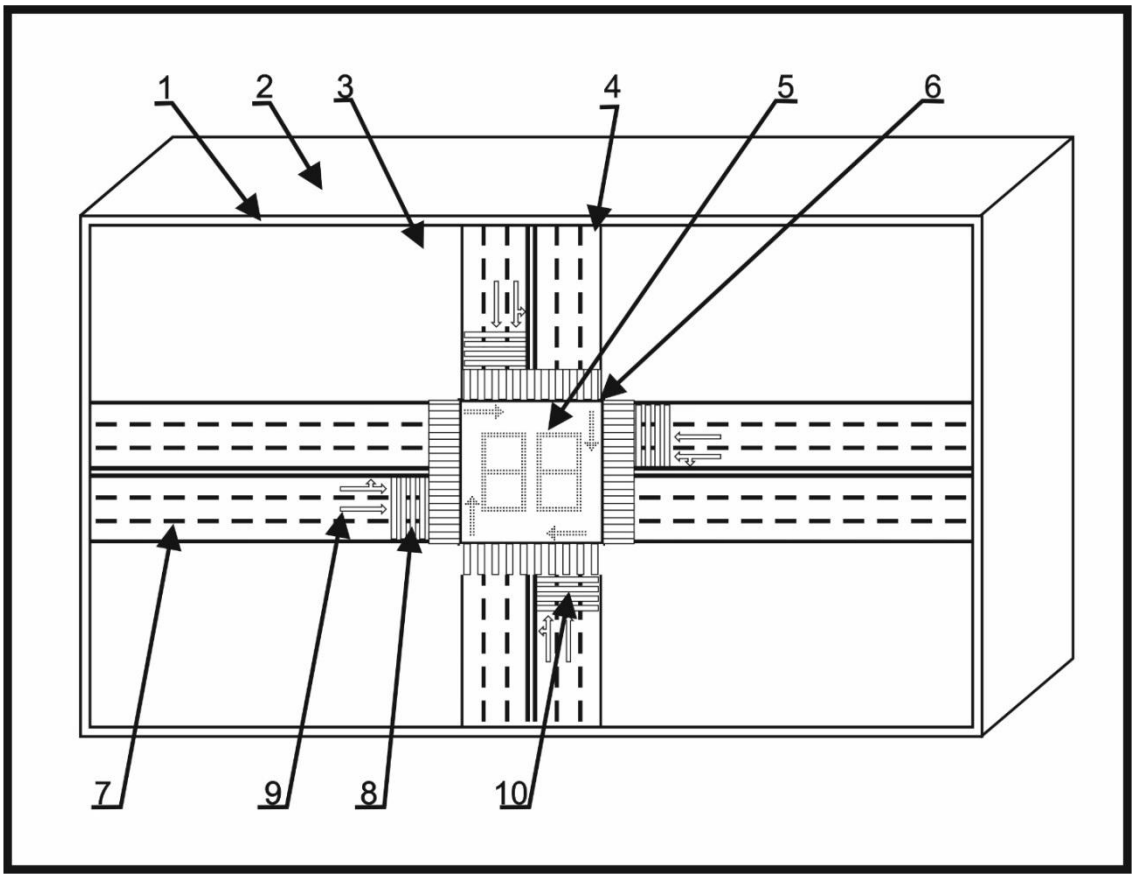


Figure. 2. Schematic representation of a multifunctional traffic light.

The appearance of the multifunctional traffic light is rectangular, its width is longer than its height, and the base is painted in a light airy color. The main road is green, the secondary road is red. The direction of travel on the main and secondary roads is indicated by white lines painted on them.

There is a pedestrian crossing at the multifunctional traffic light at the intersection of roads. It is painted white and yellow.

There are four red lines painted on the main road and four green lines on the minor road indicating that vehicles entering the intersection must give way to each other when the traffic lights are not in operation.

In the area where the main and secondary roads connect, that is, in the center of the intersection, there is a dial. It flashes green, red and displays numbers about 50 cm in size. Surrounding the numbers are

arrows glowing green and red, indicating a left turn. Depending on the type of intersection, the appearance of the traffic light is adapted to it. For example, U-shaped, T-shaped.

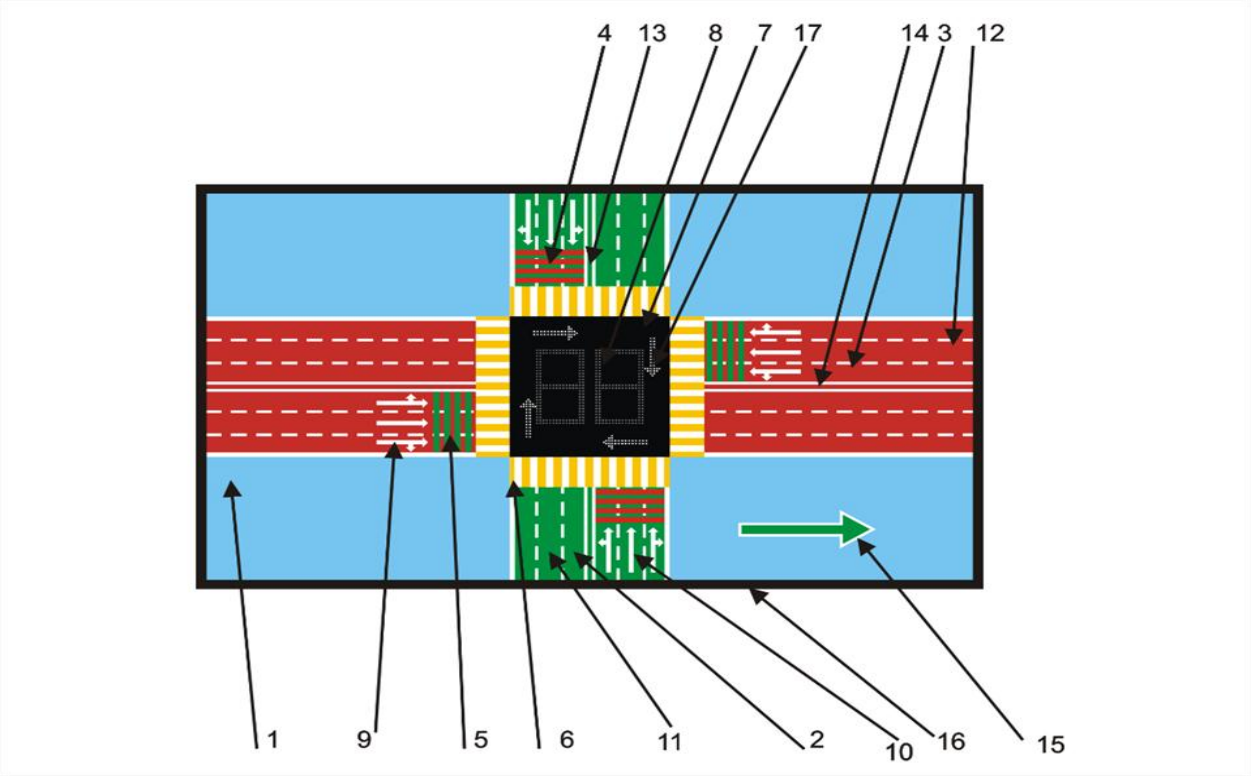


Figure. 3. Multifunctional traffic light.

1- The base of the traffic light is painted in a light color.

2- Main road. Painted green.

3- Secondary road. Painted red.

4- Red lines painted on the main road.

5- Green lines painted on a minor road.

6- Pedestrian crossing.

7- Center of road intersection (crossroads).

8- Traffic light dial.

9- White lines painted on a minor road indicate the direction of movement of vehicles on that road.

10- White lines painted on the main road indicate the direction of movement of vehicles on the main road.

11- Main road lanes

12- Lanes of secondary road

13- Lines dividing the main road into two parts.

14- Lines dividing a minor road into two parts.

15- Arrow indicating right turn.

16- Traffic light flange.

The operating principle of a multifunctional traffic light.

This traffic light is multifunctional and works like a real traffic light when there is electricity at the intersection. When the traffic light turns green, a green countdown timer starts at the center of the

intersection and traffic on the main road flows through the intersection until it reaches zero. When the light is red, a red countdown stopwatch starts at the center of the intersection and vehicles on the minor road cross the intersection until it reaches zero.

Surrounding the numbers on the dial are green and red flashing arrows indicating left turns. Turning left is allowed when the green arrow is on, turning is stopped when the red arrow is on.

If there is a power outage at an intersection and the traffic light does not work, then another function of the traffic light appears, i.e. eliminating traffic jams at intersections.

The implementation of this work consists of several stages:

1. Drivers wait until the intersection is clear in accordance with previously acquired knowledge;
2. Cars stop as close to the sidewalk as possible, but do not step on or run over the sidewalk;
3. If a person is moving along the sidewalk at this time, drivers must give way to him;
4. After this, vehicles located on the main road, that is, the green road, will start moving first;
5. The intersection is crossed by three cars from each lane of the main road. The number of cars depends on the number of lanes on the road. For example, if the number of lanes on the road is two, then the first six vehicles will cross the intersection on each side of the main road, if the number of lanes is three, then there will be nine on each side, etc.;
6. Until the empty spaces on the main road are filled by vehicles coming from behind, the intersection is crossed by vehicles of the secondary road, that is, on the red road, as indicated above;
7. These actions will continue until the traffic light starts working. Vehicles are prohibited from stopping in the center of the intersection.

Based on the work done, we came to the following conclusions about the multifunctional traffic light:

1. Multifunctional traffic light meets modern requirements.
2. A large number of traffic lights and road signs at some intersections can be replaced by four multifunctional traffic lights or road signs offered by us.
3. The multifunctional traffic light clearly indicates after what time vehicles on the secondary road must give way to vehicles on the main road, both with and without electricity.
4. Clearly defines when vehicles traveling on a secondary road can continue driving.
5. White arrows indicating the main and secondary roads on a multifunctional traffic light are convenient for drivers.
6. Multifunctional traffic light meets modern requirements.
7. The use of multifunctional traffic lights prevents large traffic jams.
8. Can also be used as a multifunctional sign at intersections with relatively little vehicle traffic. This will have a positive impact on energy and fuel savings, as well as on the quality of the local environment.
9. In the event of a power outage, traffic safety can be easily managed using signs on the multifunctional traffic lights.
10. There is no need to use the help of a road safety specialist to manage traffic safety during a power outage, as a result, damage to the health of workers is eliminated.
11. These traffic light signs are clearly visible to drivers from afar, and when there are traffic jams, drivers are confident that they will not remain stuck in a traffic jam for long. As a result, drivers are not nervous and the driving culture improves.

12. Reduces fuel consumption by quickly eliminating traffic jams.
13. Reduces environmental damage caused by excessive fuel consumption in long traffic jams.
14. A multifunctional traffic light signals that a vehicle moving on the main road at an intersection must give way to vehicles on a secondary road when approaching the intersection, as a result of which the vehicle owner is forced to reduce speed at the intersection. This situation prevents possible accidents at the intersection.
15. Launching the production of multifunctional traffic lights and selling them abroad will bring material benefits to the state.
16. As a result of the use of a multifunctional traffic light, there is no need to use the signs “Main Road”, “Direction of the Main Road”, “Give Way”, “Pedestrian Crossing”.
17. If necessary, the traffic light may be equipped with a sign for trucks, motorcycles, horse-drawn carriages or "Stop", cameras and other signs as necessary.
18. Training manuals on multifunctional traffic lights and signs will be created.
19. This traffic light and road sign are more economical than currently used traffic lights.
20. The introduction of traffic lights and a new road sign will be a bold step in implementing the World Health Organization recommendations on road safety.
21. Most importantly, the number of fatal accidents at intersections will sharply decrease.

Summary. Year after year, problems on the world's roads are getting worse. According to the United Nations Economic Commission for Europe (ECE) 2006 Report on the 1968 Geneva Convention "Road Signs and Signals", the rules are periodically updated to take into account the growing requirements for the safety of people, protection of the external environment, and rapidly advancing technological progress around the world (Report IEC UN, New York and Geneva, 2007). Unfortunately, for about a hundred years now, no drastic measures have been taken against the causes of road traffic accidents around the world. There were no reductions in the number of crash deaths in any low-income country from 2013 to 2016. LMICs only account for 60 percent of the world’s registered vehicles but more than 90 percent of the world’s crash deaths. Crash injuries place a major economic burden on LMICs. It is estimated that LMICs will experience approximately $834 billion dollars (in 2010 USD) in economic losses from 2015–2030 due to fatal and nonfatal crash injuries

Our research is focused on reducing intersection congestion, traffic accidents and related deaths. A new road sign and traffic light were invented. According to the conclusions of domestic and foreign scientists, the invented sign and traffic light should be a great success in practice.

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