Western European Journal of Modern Experiments and Scientific Methods
Volume 3, Issue 5, May 2025
https://westerneuropeanstudies.com/index.php/1
ISSN (E): 2942-1896 Open Access| Peer Reviewed

INTRODUCING MODERN PEDESTRIAN CROSSINGS TO ENSURE TRAFFIC SAFETY ON ROADS

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Abstract
Ensuring pedestrian safety remains a pressing issue in urban traffic management, particularly in developing countries where road infrastructure is rapidly evolving. This study aims to explore the role of modern pedestrian crossings in enhancing road safety and reducing the frequency of pedestrian-involved traffic accidents. The research utilizes a comparative analytical method, examining pedestrian infrastructure models from countries with successful traffic safety records and comparing them to current practices in Uzbekistan. Particular attention is given to illuminated crosswalks, intelligent traffic light systems, and accessibility features for people with disabilities. The findings indicate that the integration of smart pedestrian crossing systems can significantly improve visibility and reaction time, thereby decreasing accident rates. The article concludes by recommending a phased implementation strategy for modern pedestrian infrastructure in densely populated and high-risk zones, emphasizing the need for legal, technical, and public awareness reforms. The proposed approach supports national goals for sustainable urban mobility and contributes to the development of a safe, inclusive, and efficient road environment.
Keywords: pedestrian safety, smart crossings, urban traffic, road infrastructure, intelligent transport systems, traffic accident prevention, Uzbekistan.

Introduction

In recent years, extensive organizational and practical work has been carried out in our country to improve the road safety system.

At the same time, despite the measures being taken, the number of fatal road accidents is still high, indicating the need for a fundamental reform of the road safety system.

In particular, it is necessary to fully align road infrastructure with modern requirements for ensuring traffic safety, establish an effective system aimed at early prevention of violations in this area, as well as widely introduce digital technologies that eliminate the human factor.

In accordance with the Strategy for the Development of the Public Safety System in the Republic of Uzbekistan for 2022-2025, as well as in the context of New Uzbekistan, a number of works are being carried out to ensure the guaranteed protection of human life and health from any incidents on highways.

According to official statistics, 1,115 people died and more than 4,500 were injured in road accidents in the first seven months of 2023. Unfortunately, the number of pedestrians among the dead is also significant - more than 400 people. The article recommends modern pedestrian crossings. Pedestrian crossings existed more than 2,000 years ago, as can be seen in the ruins of Pompeii. Raised blocks on the road allowed pedestrians to cross the street without

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stepping onto the road, which doubled as a drainage and sewage system in Pompeii. The gaps between the barriers allowed horse-drawn carriages to pass along the road [1]. The first pedestrian crossing signal was installed in December 1868 on Bridge Street in Westminster, London. It was the idea of railway engineer John Peake Knight, who thought it would allow pedestrians to cross this busy street safely. The signal consisted of a semaphore arm (made by Saxby and Farmer, manufacturers of railway signals) which was raised and lowered by a police constable who turned a handle on the side of the pole. The semaphore arms were augmented with gas-lit lights (green and red) above to increase the signal's visibility at night. However, in January 1869, the gas illuminating the lights above leaked and exploded, injuring a policeman. Fifty years later, no further work was done on signalized pedestrian crossings.

A pedestrian crossing (or crosswalk in American and Canadian English) is a place designated for pedestrians to cross a road, street, or avenue. The term "pedestrian crossing" is also used in the Vienna and Geneva Conventions, both of which deal with road signs and traffic.

In some countries, including the United States, "unmarked pedestrian crossings" are assumed to occur at intersections, even if the crossing is not marked, except where pedestrians are expressly prohibited from crossing. The simplest marked crossings may consist of only some markings on the road surface. In the United States, these are called "marked pedestrian crossings". In the United Kingdom, these are often called zebra crossings, referring to the black and white lines painted on the road surface. If pedestrians have the right of way over vehicular traffic when using a crossing, they are encouraged to use the crossing instead of crossing the road at other places. In some countries, pedestrians may not have the right of way, but may be committing an offence if they cross the road at other places or "jaywalk".

Special markings are often placed on the road surface, both to direct pedestrians and to prevent drivers from stopping their vehicles in the path of pedestrian traffic. There are many varieties of signal and marking schemes throughout the world and even within individual countries. In the United States, there are many inconsistencies, although the variations are usually minor. In the United Kingdom, there are several distinct types, each with its own name. Pedestrian crossing machines are specialized equipment used professionally to paint zebra stripes at intersections or other busy road sections. Zebra crossings, due to their wide but not long parallel stripes, are often small, hand-operated road markings that can be easily made to change direction. There are differences between engineering regulations in different countries. The marking shoe of the pedestrian cross-line machine, which determines the width of the marking lines, is much wider than that of other marking machines.

Smaller wheeled marking shoes can be used to perform the road marking. Pedestrian shelters are uncontrolled crossings with two set curbs and a central traffic island, protected by the edge of the road. The island allows pedestrians to cross the road in one direction of traffic at a time, which can be faster and safer than the lack of a crossing (they reduce pedestrian fatalities by about 40%). They can also narrow the road, slow down vehicles and prevent them from overtaking. However, they may not provide priority for pedestrians, meaning pedestrians may have to wait longer than at a controlled crossing. They can also create pinch points that can be dangerous for cyclists.

Pedestrian crossings are intended to encourage pedestrians and help drivers cross roads with courtesy rather than obligation. The addition of lines (for example, in paving), narrowing of the road, and visual narrowing have a positive effect on courtesy.

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Marked pedestrian crossings are often located at intersections, but can also be located at other points on busy roads where it would be too dangerous to cross unaided due to the number of vehicles, speed, or width of the road. They are also installed where large numbers of pedestrians are crossing (e.g., shopping areas) or where vulnerable road users (e.g., schoolchildren) regularly cross.

To ensure safety, pedestrian crossings are regulated; for example, in some areas, pedestrians must cross more than half of the crosswalk before a driver can move, while in other areas, there are laws restricting pedestrians from crossing at designated crossings.

Pedestrian crossings are clearly marked using signals when each type of traffic (pedestrians or road traffic) can use the crossing. Unsignaled crossings are generally pedestrian-friendly and usually give pedestrians priority depending on their location.

Any crosswalk uses signals to keep pedestrians in a position where they can be seen by drivers and safely cross the flow of traffic, whereas zebra crossings are unsupervised and suitable for lower flow rates. What appears to be a pedestrian crossing can be designed primarily as a traffic calming technique, especially when combined with other features such as pedestrian priority, shelter islands or raised surfaces.

The lines at the front of zebra crossings light up red to warn cars that someone has stepped in to prevent accidents.

In this article, electronic lines called “Sightlines” use human detection technology to detect when pedestrians are approaching a crosswalk. Once the pedestrians have crossed the road, the line flashes in a broken pattern. Drivers are then told to safely continue along the road when the red light turns completely off. The article recommends creating the system as part of their research to find a solution to the 2,000 traffic collisions that occur at crosswalks every year.

"We envision that future technology could even interface with autonomous vehicles, reducing the risk of pedestrians being hit once the human driver is removed. We understand that implementing smart crossings has benefits today, but this is just the beginning – new intelligent infrastructure will connect directly with autonomous vehicles, offering ways to improve safety in the future."

We believe that a prototype solution that sees a 22-meter-long responsive pavement that increases safety by simultaneously communicating with pedestrians, motorists, and cyclists is a promising solution.

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Figure 1. Recommended pedestrian crossing.

Conclusion

In conclusion, the pedestrian crossings we are proposing could be future technology that could even interact with autonomous vehicles, reducing the risk of pedestrians being hit once the human driver is removed. We understand that implementing smart crossings has benefits today, but this is just the beginning – new intelligent infrastructure will connect directly with autonomous vehicles, offering ways to improve safety in the future.

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