

*Qurbonova N.U.*

*A master's student at Fergana Polytechnic Institute.*

*[nilufarqurbonova11@gmail.com](mailto:nilufarqurbonova11@gmail.com)*

## THE CLASSIFICATION OF VEHICLE MOVEMENT AT CITY ROAD INTERSECTIONS AND THE ANALYSIS OF VEHICLE MOVEMENT AT EXISTING INTERSECTIONS (USING THE EXAMPLE OF FERGANA REGION)

**Abstract:** This article investigates the architectural solutions for designing road intersections in the city of Fergana. The analysis of vehicle movement at the intersection of the city's automobile road is conducted, utilizing statistics of pedestrian and traffic flows. The study identifies issues related to vehicle movement and pedestrian flow, as well as examines the geometry of the intersection and safety measures. Additionally, the article discusses the role of innovative technologies used in modern road intersections, including ecological and smart systems. It highlights how road intersections can be made more efficient through green design and smart technologies. Furthermore, the article presents a special project proposal for the city of Fergana, which includes a design meeting the highest standards in terms of seismic safety, material selection, and infrastructure. The project also suggests the construction of green zones, shopping centers, and bridges equipped with smart technologies. It is known that, with the help of innovative solutions, bridges not only manage traffic but also contribute to the ecological and social development of the city. In conclusion, the selected project sketches for Fergana city intersections are described, along with their advantages.

**Keywords:** City street intersections, architectural solutions, Fergana city roads, traffic analysis, pedestrian flow, innovative solutions.

### I. Introduction

Cities have become the main centers of population growth, urbanization, and economic development on a global scale. The efficiency of urban infrastructure, the improvement of the quality of life for residents, and the safety of transport systems are interrelated, and the optimal management of traffic flow is a key issue. Road intersections in urban streets—such as pedestrian walkways, bridges, and junctions—play a crucial role in efficiently managing both vehicle and pedestrian movement, as well as ensuring safety. Their design and architectural solutions are directly relevant to the development of cities [1]. Fergana city, with its economic growth, increasing population, and expanding urban infrastructure, is facing pressing issues in the field of transport traffic and safety. The modern design styles of road intersections in urban streets, their architectural design, and integration with innovative technologies contribute to improving the efficiency and safety of the city's transport system. However, some intersections in Fergana are still facing challenges in managing traffic flow effectively and ensuring pedestrian safety. This is particularly evident in the increased movement of vehicles, the occurrence of traffic congestion, and the lack of safe crossings for pedestrians [2–3].

The relevance of the topic lies in the fact that the efficiency and safety of modern urban transport infrastructure serve as a critical factor for the well-being of the population and the economy of the city. Improving the transport system and ensuring safety in Fergana city through architectural solutions for road intersections and the application of innovative technologies is especially urgent today. These issues call for the effective management of traffic flow in city streets, reducing traffic jams, and creating safe crossings for pedestrians.

**Objective** – The aim of this study is to analyze the architectural solutions for road intersections in the streets of Fergana city, identify existing problems, and propose recommendations to improve the efficiency and safety of these intersections through the application of modern innovative technologies. The article provides an analysis of traffic and pedestrian flow at the intersections of "Vatan Ravnaqi" and "Dodhox" streets in Fergana city, along with recommendations related to modern design approaches and innovative solutions [4].

## II. The classification of vehicle movement at the "Vatan Ravnaqi" and "Dodhox" street intersection of Fergana city and the analysis of vehicle movement at the existing intersection.

To ensure the effective management and safety of vehicle movement at the intersection, it is necessary to consider a range of analytical factors. The importance of managing the movement of both pedestrians and vehicles in harmony must be taken into account when designing road intersections in urban streets. At this stage, the geometry of the road intersections, the analysis of pedestrian and traffic flow, and safety issues need to be studied. To measure the crossing speed of pedestrians, the following formula is used [5–6]:

**Pedestrian Flow ( $Q_p$ ) Calculation:** The pedestrian flow, denoted as  $Q_p$ , is calculated using the formula:

$$Q_p = N/T$$

Where:

$Q_p$  is the pedestrian flow (pedestrians per hour or pedestrians per minute),

$N$  is the number of pedestrians crossing the intersection,

$T$  is the time period (in minutes or hours).

Example 1:

If the number of pedestrians crossing the intersection is  $N=80$  in a time period of  $T=1$  minute, the pedestrian flow is:

$$Q_p = 80/1 = 80 \text{ [1/min]}$$

Example 2:

During peak hours (from 16:00 to 18:00), if the number of pedestrians crossing the intersection is  $N=120$  in 1 minute, the pedestrian flow becomes:

$$Q_p = 120/1 = 120 \text{ [1/min]}$$

**Pedestrian Speed ( $V_p$ ) Calculation:**

The speed of pedestrians, denoted as  $V_p$ , can be calculated using the formula:

$$V_p = L/T_p$$

Where:

$V_p$  is the pedestrian speed (in meters per second),

$L$  is the crossing distance (in meters),

$T_p$  is the time taken by the pedestrian to cross (in seconds).

Example:

If the crossing distance is  $L=20$  meters and the pedestrian takes  $T_p=20$  seconds to cross, the pedestrian speed is:

$$V_p = 20/20 = 1 \text{ m/s}$$

**Pedestrian Walkway Width ( $W$ ) Calculation:**

To calculate the width of the pedestrian walkway, we use the formula:

$$W = Q_p/N_w$$

Where:

$W$  is the walkway width (in meters),

$Q_p$  is the pedestrian flow (pedestrians per second),

$N_w$  is the width required for each pedestrian to cross (in meters).

Example:

If the pedestrian flow is  $Q_p=20$  pedestrians per second, and each pedestrian requires  $N_w=0.75$  meters to cross, the walkway width is:

$$W=20/0.75=26.6\text{meters}$$

These calculations help in ensuring that the pedestrian movement is efficiently managed, the intersection geometry is well-designed, and the safety of pedestrians is guaranteed while crossing.

### III. Innovative Solutions for Modern Road Intersections

It is crucial to consider both ecological and technological aspects in modern road intersections. Today, several innovative solutions are being implemented in road infrastructure:

#### 1. Sustainability and Green Design

Energy-saving and the use of eco-friendly materials make bridges more efficient. For example, generating energy with photovoltaic panels, using eco-friendly materials, and renewable resources increase the energy efficiency of bridges. Green roofs and vertical gardens are also architectural solutions that can be seen in such projects.

#### 2. Creation of Socially Beneficial Zones

Projects, similar to those in European cities, must meet not only transport needs but also the needs of pedestrians. Green zones, playgrounds, shopping centers, sports areas, and library corners increase the utility of bridges for the public.

#### 3. Digital and Smart Technologies

Road traffic is monitored with sensors and artificial intelligence systems. For example, monitoring and analyzing the condition of bridges can ensure safety. IoT (Internet of Things) technologies allow for automatic system management and optimization of road traffic.

#### 4. Socioeconomic Potential

Creating green spaces and commercial areas within road intersections contributes to the city's economy. These types of projects serve as a key factor in uniting society and improving the quality of life.

### Proposed Road Intersection Project for Fergana City at the "Vatan Ravnaqi" and "Dodhox" Street Intersection

The project for the intersection of Fergana city's "Vatan Ravnaqi" and "Dodhox" streets should be implemented with the following requirements in mind:

#### 1. Structural Safety

The project will utilize earthquake-resistant reinforced concrete columns and shock-absorbing dampers to absorb dynamic loads. Seismic isolation systems will be incorporated to reduce seismic vibrations.

#### 2. Material Selection

High-strength concrete, such as C50/60 or higher-grade concrete, will be used along with corrosion-resistant steel materials. Additionally, concrete mixes incorporating plastic materials will be used to enhance durability.

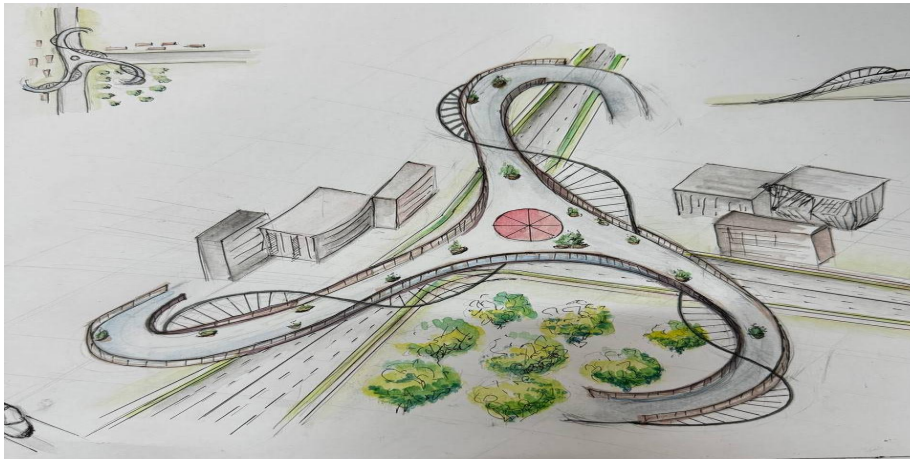
#### 3. Design Requirements

The intersection's design will take into account road traffic and pedestrian flow, ensuring an

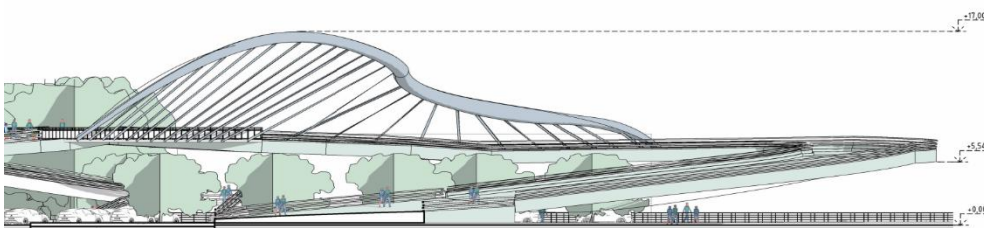
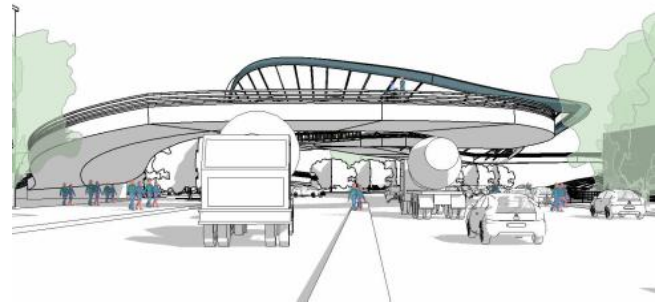
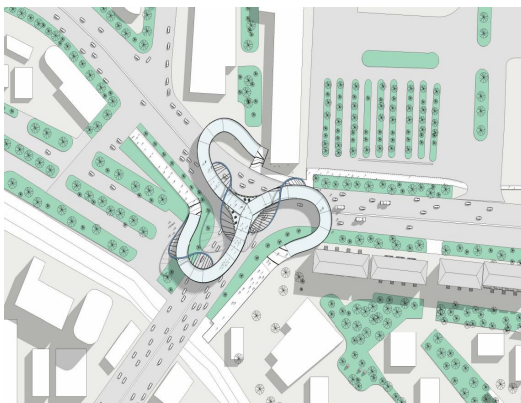
optimal road system. The bridge will have a clearance height of at least 5 meters. Green spaces and commercial areas will also be incorporated into the design.

#### 4. Innovative Solutions

The project will feature solar panels, smart systems, and LED lighting. Sensor technologies and smart road signs will be implemented to enhance safety and improve traffic management. This proposed project aims to meet the functional, aesthetic, and safety requirements of the intersection, contributing not only to improved traffic management but also to the overall development of Fergana city's infrastructure.



"Figure 1: A sketch design of a pedestrian crossing equipped with electronic vehicle devices and providing accessibility for the elderly and disabled by creating wide green walkways."



**"Figures 2-3-4: The 3D view of the drawn sketch.**

The project proposal also takes into account the aesthetic aspects of the area, and the green spaces are specially designed for pedestrians. A large part of the area, along with green walkways, is equipped with electronic vehicle devices, which are particularly beneficial for the elderly and disabled. Moreover, this area plays a significant role in attracting tourist traffic. Additionally, special commercial corners for entrepreneurs have also been included in the project plan

**IV. Conclusion**

The design of road intersections and their architectural solutions in city streets are of significant importance in ensuring the efficiency and safety of urban infrastructure. The analysis of existing intersections and roadways in Fergana city shows that managing traffic flow and ensuring pedestrian safety are key issues that need to be addressed. Additionally, the application of modern innovative technologies and the consideration of ecological and social aspects in the architectural solutions of urban road intersections are important.

Taking the intersections of "Vatan Ravnaqi" and "Dodhox" streets in Fergana city as an example, it is essential to analyze the flow of moving vehicles and pedestrian safety, identify existing problems, and propose solutions to eliminate them. Modern architectural solutions for bridges and road intersections, considering innovative technologies and ecological factors, will contribute to the sustainable development of cities. Furthermore, the social and economic potential of road intersections should also be considered. By creating additional social opportunities such as green spaces, playgrounds, and sports zones, the quality of life in cities can be improved.

Thus, designing effective road intersections not only improves the transport system but also creates a comfortable and safe environment for urban residents. Based on the above analyses and proposals, the design of road intersections in Fergana city, integrating modern architectural solutions, innovative technologies, and social demands, contributes to the development of urban infrastructure. This, in turn, serves the safe and sustainable development of cities, efficient traffic flow management, and the improvement of residents' well-being."

**References:**

1. Sirojiddinov, Sh. R. (2017). Design of urban roads and transport systems. Tashkent: Academy of Sciences of Uzbekistan Publishing House.
2. Abduazizov, M. R. (2020). Modern methods of designing road intersections. Tashkent: O'zavtotrans Publishing House.
3. Davronov, B. S. (2018). Urban infrastructure development and improving road safety. Fergana State University, Scientific Journal.
4. Jabborov, I. K. (2022). Ecological and social design of urban bridges. Tashkent: Tashkent Institute of Architecture and Construction Publishing House.
5. Zaynalov, A. T. (2019). Modernizing road intersections using innovative technologies. Tashkent: Journal of Transport and Construction Systems.
6. Khalilov, R. M. (2021). Analysis and effective management of traffic flow on urban roads. Tashkent: Transport and Logistics, pages 45-49.
7. Abdullayev, O. S. (2019). Modernizing the transport system of Fergana city. Fergana, Scientific Journal, pages 30-33.

8. Xolmatov, D. S. (2018). Architectural solutions and improving the quality of the urban environment. Tashkent: Tashkent Institute of Architecture and Construction Publishing House.
9. Tashkent, N. A. (2020). Integrated development of urban infrastructure. Tashkent: Academy of Science and Technology.