INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 12, issue 05 (2025)

PROBLEMS OF TRAFFIC FLOW MANAGEMENT IN THE DESIGN OF INTERNAL CITY ROADS AND PROPOSALS FOR THEIR ELIMINATION

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Annotation: This article highlights problems related to traffic flow management in the process of designing internal roads in the cities of Uzbekistan. Conditions such as traffic jams, incorrect positioning of traffic lights, and lack of parking spaces were analyzed in general. On the example of some cities of the republic, the causes of the problem are revealed, and practical proposals for their elimination are put forward.
Keywords: urban internal roads, traffic flow, congestion, road design, traffic lights, parking, safety, Uzbekistan

Introduction. Today, the cities of Uzbekistan are developing rapidly, the population and the number of vehicles are growing significantly. This situation, in turn, creates the need to update and expand the infrastructure of internal roads and effectively manage traffic flow. Internal city roads are important not only for traffic, but also for the movement of pedestrians, public transport, and emergency services [1-3]. However, in practice, problems related to traffic flow - traffic jams, incorrect positioning of traffic lights, lack of parking spaces, etc. - are widespread. This article analyzes problems related to traffic flow management in the design of internal roads using the example of cities in Uzbekistan and puts forward proposals for their solution [4].

Table 1.

Example of traffic flow and congestion problems by cities (as of 2024)

City	Population (thousand)	Number of cars (thousand)	Highest traffic hours	Fundamental problem
Tashkent	2,800	600	08:00-10:00/17:00-19:00	Unaccomplished traffic lights Not enough parking spaces
Samarkand	1000	230.	07:30-09:30/16:30-18:30	Intersections narrow, few road signs
Andijan	800	180.	07:00-09:00/17:00-19:00	No parking spaces, narrow sidewalks

Methodology. Main problems in the design of internal city roads**:** The system of internal roads in the cities of Uzbekistan does not fully meet the ever-increasing traffic flow. The basis of the problem lies in the fact that the existing infrastructure is built according to outdated standards, and modern approaches are not sufficiently applied in urban planning [5,6]. Traffic jams have become

commonplace, especially in large cities - Tashkent, Samarkand, Andijan, Namangan, and Fergana. The reasons for this are the non-compliance of road widths with the standard, the lack of automation of traffic lights, and the inefficient planning of intersections. The lack of coordination of traffic light systems, which is one of the main means of managing traffic flow, is the reason for the accumulation of traffic at many intersections. This problem is especially acute in the morning and evening hours, when going to work and returning from work. In addition, improper coordination of pedestrian and public transport movement also negatively affects the consistent movement of traffic flows. On many city roads, there are no pedestrian paths or they are narrow, and pedestrians are forced to walk on highways. The lack of dedicated lanes for public transport leads to buses and minibuses getting stuck in traffic jams, which leads to a loss of time for the population.

Suggestions for Troubleshooting- To address problems related to traffic flow management on city roads, the following suggestions are proposed:

- It is possible to liberalize traffic flow by redesigning road infrastructure, expanding existing roads, optimizing intersections, and building new, modern intersections. In particular, the introduction of one-way traffic will reduce traffic congestion on some narrow streets.
- By connecting traffic lights to intelligent control systems (ATS - automatic transport system), it is necessary to implement traffic density-based algorithms. This helps optimize flow during rush hour.
- The development of a parking system can reduce parking problems on central streets by building multi-story, underground, or remote parking lots. In this case, a procedure will be introduced through a paid parking system.
- Prioritizing public transport, allocating separate lanes for buses and routes, updating public transport, and fully connecting it to the GPS system can increase the efficiency of transport services.
- The construction of wide, safe pedestrian walkways and underground/passage roads along roads to create conveniences for pedestrian traffic serves to separate pedestrian and vehicle traffic. This ensures overall traffic safety.

Results and Discussion

Efficient traffic flow management on internal city roads is a complex issue that impacts not only road infrastructure but also social, economic, and environmental aspects. This paper has identified the major problems encountered in managing urban traffic flow and proposed actionable solutions for their mitigation.

In many cities, especially in developing regions, urban road networks are planned without adequate consideration for traffic volume and road capacity. This results in narrow streets, inefficient intersections, and poorly placed traffic signs, leading to congestion. In several urban areas, traffic management systems are outdated and fail to meet modern demands. This contributes to increased traffic congestion and reduces road safety. City road infrastructure is often designed with a bias toward motor vehicles, with little or no infrastructure for pedestrians and cyclists. This not only affects pedestrian safety but also contributes to environmental degradation.

Proposals:

- Promote the use of environmentally friendly vehicles such as electric and hybrid models.
- Develop urban transport policies that consider social impacts and public well-being.

Table 2.

Table: Major Problems in Urban Traffic Flow Management and Proposed Solutions

Problem	Proposed Solutions
Improper urban road network	Plan networks based on traffic data and optimize intersections

planning	and signage systems
Outdated traffic control systems	Implement smart traffic control systems using real-time data and AI technologies
Overemphasis on private vehicles	Build pedestrian and bicycle infrastructure, promote public transportation
Parking challenges	Expand parking capacity and digitize parking systems
Environmental and social impacts	Encourage use of eco-friendly vehicles and socially-aware urban planning

Conclusion. The problems considered above and proposals for their elimination show that the cities of Uzbekistan face the need to modernize the infrastructure of internal roads. The current situation has a direct impact not only on traffic, but also on the quality of life of the city's residents and the ecological environment. Effective operation of the urban transport system can be achieved by properly managing traffic flow, preventing traffic jams, facilitating public transport movement, and creating conditions for pedestrians. The proposed measures - the expansion of infrastructure, the introduction of smart management systems, the expansion of parking lots, and the prioritization of public transport - are based on modern road engineering approaches. Effective operation of the urban transport system can be achieved by properly managing traffic flow, preventing traffic jams, facilitating public transport movement, and creating conditions for pedestrians. The proposed measures - the expansion of infrastructure, the introduction of smart management systems, the expansion of parking lots, and the prioritization of public transport - are based on modern road engineering approaches.

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