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The "Engineer" publishes the most significant results of scientific and applied research carried out in universities of transport profile, as well as other higher educational institutions, research institutes, and centers of the Republic of Uzbekistan and foreign countries.

The journal is published 4 times a year and contains publications in the following main areas:

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- Automotive Engineering;
- Civil and Structural Engineering;
- Computational Mechanics;
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- Mechanics of Materials;
- Safety, Risk, Reliability and Quality;
- Media Technology;
- Building and Construction;
- Architecture.

Tashkent State Transport University had the opportunity to publish the international scientific journal "Engineer" based on the **Certificate No. 1183** of the Information and Mass Communications Agency under the Administration of the President of the Republic of Uzbekistan. **E-ISSN: 3030-3893, ISSN: 3060-5172.** Articles in the journal are published in English language.

Improvement of bus traffic in cities based on foreign experience (on the example of the city of Jizzakh)

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Abstract: This article examines the scientific and theoretical directions for improving the efficiency of intercity public transport, in particular bus traffic, based on international experience. The study was conducted using the example of the transport system of the city of Jizzakh, where existing problems, passenger flows, infrastructure capacity, route networks, and the management system were analyzed. Advanced approaches of foreign countries - smart transport systems (ITS), bus priority measures, real-time monitoring, integrated tariff systems, and the practical application of digital management models were studied. Scientifically based proposals and recommendations have been put forward to increase the stability of traffic in the conditions of Jizzakh.

Keywords: public transport, bus traffic, ITS, passenger transportation efficiency

1. Introduction

Sustainable urban development is directly related to the possibility of safe, convenient, and economical movement of the population. Today, public transport is the main pillar of the urban transport system, ensuring the ecological, economic, and social efficiency of passenger transportation. Bus transport is the most widespread type of public transport in the cities of Uzbekistan. Population growth, urbanization, and a rapid increase in the level of motorization lead to a decrease in the capacity of existing roads, an increase in the number of traffic jams, and a decrease in the efficiency of the public transport system.

In recent years, large-scale reforms have been carried out worldwide to digitalize public transport, manage it based on smart systems, prioritize buses, and optimize the tariff and route system. Foreign experience shows that prioritizing public transport allows reducing city congestion by 15-30%, reducing the time spent per passenger by 20-25%, and reducing environmental pollution by 10-15%.

This issue is also relevant for the city of Jizzakh, and there is a need to improve the quality of passenger transportation within the city, optimize bus services, modernize the infrastructure of bus stops and corridors, and introduce modern management systems. This research is aimed at developing scientific foundations for improving bus traffic using the example of the city of Jizzakh.

International scientific sources highlight the following areas for increasing the efficiency of public transport:

- Intelligent Transport Systems (ITS): Real-time monitoring, automated passenger metering system (APC), route optimization algorithms
- Bus Priority Measures: Priority in BRT and BRT-lite systems (Bogota, Istanbul, Seoul), bus lanes, signal settings
- Digitalization of the tariff and payment system: London Oyster, Istanbul Istanbulkart, Singapore NETS systems, integrated tariff policy
- Modeling of passenger flows: Microsimulation (PTV Visum, Vissim), Indicators for assessing flow efficiency.

Studies show that when using modern control systems, the average speed of buses increases by 18-25%, and operating costs decrease by 12-15%.

2. Research methodology

The study was conducted in the following stages:

- Preliminary transport analysis. 16 main bus routes in the city of Jizzakh were studied, daily passenger traffic was analyzed, and the condition of bus stops was assessed.

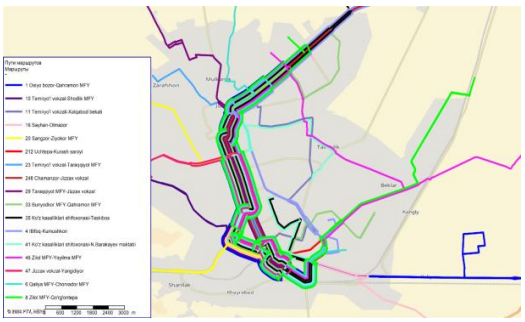

Fig. 1. Overview of the city's public transport network

According to the results of GIS analysis, as of March 2023, residents of 10 out of 78 mahallas are in the zone of transport discrimination based on public transport stops, which is 26% of the population of the area.

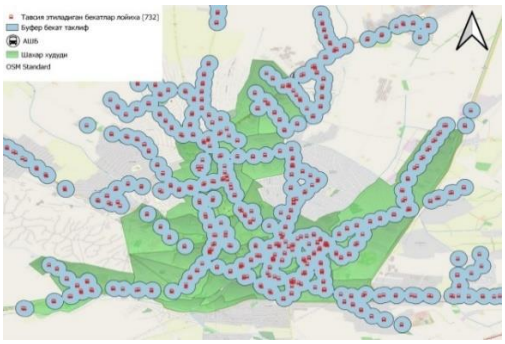

Fig. 2. Cartogram of the level of coverage of the agglomeration area with public transport stops, i.e., the current state of pedestrian convenience

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Diagnosis and problem identification. Route duplication, impact of traffic jams on bus traffic

At the same time, according to a selective assessment of route speeds on urban and suburban routes of the city of Jizzakh and the Jizzakh agglomeration (March 2023), on most city bus routes, the route speed does not exceed 20 km/h, and in some segments, it can decrease to 8 km/h in the city center. With such a low route speed, the average speed of routes decreases significantly, especially considering the low reliability of transportation. This reduces the attractiveness of public transport and encourages the use of individual transport and taxis for daily trips, taking into account the specifics of their activities in the city of Jizzakh.

In adapting foreign experience to the conditions of Jizzakh, attention was paid to the possibility of implementing the BRT-lite model, a digital management system (Dispatch system), and the redistribution of passenger flows. Based on the model, the forecast results and expected changes in transport efficiency indicators were calculated.

3. Results and discussion

The study revealed the following:

1. Low bus speed in the city of Jizzakh

The average speed is 18-22 km/h.

On some routes, the distance between stations is far from the norm (850-1100 m).

2. Routes not optimized

The 3 directions duplicate each other by more than 70%.

There is an uneven distribution of passenger flows.

3. ITS system unavailable

GPS tracking is partially implemented, but there is no real-time monitoring.

An automated payment system has not been developed.

4. Insufficient modernization of the infrastructure

45% of stations do not have closed pavilions.

There are no dedicated bus lanes.

5. Foreign experience is suitable for Jizzakh

With the implementation of the BRT-lite system, the average speed will increase to 26-30 km/h.

With the introduction of ITS, bus delays will be reduced by 40%.

The digital payment system reduces costs by 10-12%.

Analysis of international experience shows that:

The BRT-lite model is not a large-scale BRT, but a small modification - dedicated corridors, fast descent-exit platforms, signal priority system, which is an economical option for Jizzakh.

Digital Management System - Based on the experience of London, Seoul, Singapore, the following system is proposed for Jizzakh:

- GPS-AVL system for buses
- Passenger meter (APC)
- Providing real-time information via monitors
- Automated payment system (QR-ticket)

Integrated route network. By forming transport hubs:

- Existing routes will be reduced to 25%
- New ring routes will be implemented
- Optimizes the number of stops

Socio-economic efficiency

Improvement measures:

- Improves the convenience of movement for the population
- Reduces the use of private cars
- Reduces environmental pollution
- Improves transportation quality.

4. Conclusion

Improving bus traffic in the city of Jizzakh is an important factor in increasing the overall efficiency of the city's transport system. The following measures, implemented based on foreign experience, are recommended as the most optimal solution:

1. Full implementation of smart transport systems (ITS)
   - GPS-AVL
   - Digital payment system
   - Real-time monitoring panel
2. Establish priority measures for buses
   - Custom bus lanes
   - Traffic Light Priority
   - Modernization of stations
3. Optimize route networks
   - Reducing duplicate routes
   - Opening of new circular and radial routes in accordance with passenger flows
4. Digital management and control system
   - Ensuring the discipline and adherence of buses to the schedule
   - Continuous monitoring of traffic flows
5. Increasing socio-economic efficiency
   - Time savings for the population
   - Ecological sustainability
   - Modernization of transport infrastructure

The research results serve as a practical and scientific basis for the modernization of bus traffic in the city of Jizzakh.

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