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Opportunities For Organizing Counterflow (Reversion) Traffic For Motor Vehicles

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Abstract: Managing traffic flows in modern urban infrastructure shapes the efficiency of the transport system. In recent years, the rapid growth of vehicles in major cities of Uzbekistan, especially in Samarkand, has strained existing road networks and increased congestion. Along with building new roads, the introduction of intelligent control systems and reversible traffic methods has become an urgent priority.

Keywords: Reversible movement, traffic flow, reversion system, information technology, vehicle congestion.

INTRODUCTION:

The essence of the reversible traffic method. A reversible lane redirects traffic flow by time and assigns certain lanes to one direction at specific hours and to the opposite direction at other hours. Authorities usually apply this system during morning and evening peak periods, and it can raise road capacity by up to 20 to 30 percent.

Organizational and technical foundations. Effective operation of a reversible traffic system requires the following organizational and technical conditions:

1. Geometric parameters of the road. The width of the carriageway must measure at least 10.5 to 14 meters.
2. Electronic control systems. Install light signals, electronic road signs, and dynamic display boards.
3. Central dispatch system. Manage traffic in real time through an Intelligent Transport System (ITS).
4. Safety measures. Provide visual and audio warnings before and after each change in direction.
5. Monitoring system. Use sensor networks that continuously analyze traffic density, speed, and time.

Scientific-analytical foundations. The capacity of traffic flow can be compared before and after implementing a counterflow system using the following formula:

$$Q = N/T \times k$$

Where:

- **Q** — traffic flow capacity (vehicles/hour);
- **N** — number of vehicles passing within a given time interval;
- **T** — time unit (hours);
- **k** — traffic management coefficient.

Practical studies have shown that after implementing a reversion system, the value of **Q** increases by 1.2–1.4 times. As a result, the average travel speed rises, waiting time decreases, and fuel consumption is reduced by 8–12%.

International experience. Counterflow systems have been widely implemented in the following cities worldwide:

- Seoul (Korea) — traffic capacity increased by 25%;
- Moscow (Russia) — travel time reduced by 18%;
- Los Angeles (USA) — CO_2 emissions decreased by 30%.

These results demonstrate the potential to trial a local reversion system for redistributing traffic flows in cities of Uzbekistan, including Samarkand.

Opportunities for implementing a reversion system in Samarkand.

Transport analysis in Samarkand indicates that Shakhi-Zinda Street, Usto Umar Jurakulov, and Dahbed routes exhibit asymmetric traffic loads during peak hours. In such cases, it is advisable to organize the middle lane as a reversible lane where three lanes are available.

"Traffic congestion on Dahbed Street in Samarkand city (8:30 AM)"

"Traffic congestion on Dahbed Street in Samarkand city (7:00 PM)"

A stepwise approach is recommended for the effective implementation of the system:

1. **Traffic flow modeling** using software such as VISSIM or AIMSUN;
2. **Determination of optimal time intervals** (morning 7:00–9:30 AM, evening 5:00–7:30 PM);
3. **Design of safety zones and signage systems**;
4. **Integration with information technologies** — alerting drivers through mobile applications and electronic boards;
5. **Trial period (1–3 months)** followed by full implementation based on monitoring results.

Expected outcomes. Implementing a reversion system in the central areas of Samarkand can achieve the following economic and social benefits:

- **Traffic flow capacity** — increase by 25–30%;

- **Average travel time** — reduction by 15–20%;
- **Fuel consumption and emissions** — reduction by 10–12%;
- **Need for additional road construction** — decreased;
- **Environmental load in the city center** — reduced.

CONCLUSION

The counterflow system (reversion) is a relatively inexpensive yet effective method for optimizing urban transport systems. In historical and tourist cities like Samarkand, where space for new road construction is limited, improving existing infrastructure through intelligent traffic management solutions is the most feasible approach. Therefore, implementing the reversion method, based on scientific analysis, modern ITS technologies, and safety standards, plays a key role in ensuring the stability and efficiency of the city's transport system.

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