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Материалы конференции дают отражение научной деятельности ведущих ученых дальнего и ближнего зарубежья, Республики Казахстан и могут быть полезными для докторантов, магистрантов и студентов.



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## **UDK 698**

### **WAYS TO SOLVE THE PROBLEM OF CONGESTION OF THE ASTANA CITY ROAD NETWORK**

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Annotation. The intensive development of the transport infrastructure of Astana, the capital of Kazakhstan, along with the improvement of services to the economy and population of the city revealed a few previously non-existent problems in this area. Now the task of unloading the city during rush hours is becoming more urgent, and its solution requires the development of new technical and organizational solutions, one of which is the use of a system of "intercepting" parking.

Keywords: road network, road transport, traffic congestion, rush hour, "intercepting" parking, public transport, megapolis.

Currently, one of the most pressing problems of megacities is the congestion of the road network with car flows, the number of which is increasing from year to year.

The problem of traffic congestion is also characteristic of the capital of the Republic of Kazakhstan – the city of Astana.

The main reason for the transport problem lies in the initial layout of the city without considering the possibilities of widespread use of personal cars. During the construction of the current capital, it was assumed that the number of residents of the city would not exceed 500 thousand people, but as of January 1, 2023, the population of Astana amounted to 1,212,070 residents, while a third of the residents registered personal cars - this is more than 450 thousand vehicles [1].

The next reason is the long wait of Traffic Police officers in case of an accident, so even a small collision of two cars leads to traffic paralysis.

Another problem is the unsatisfactory condition of the roadway in a few places and the long and insufficiently organized repair of streets and roads [2].

The following factors also have a negative impact:

- violation of parking rules.

- low level of culture of some drivers. For example, it has been mathematically proven that in the case of heavy traffic, a multi-kilometer traffic jam on the highway can arise simply due to a sharp rearrangement of one of the traffic participants, even without an accident. In other words, incorrect behavior of individual drivers and pedestrians can create serious congestion.

The greatest traffic load on the city's road network falls on the morning and evening rush hours, when the number of vehicles on the city's roads is maximum. The load of the main highways of the city is so great that the time it takes for car owners to reach the end point far exceeds the comfortable limits. Low traffic speeds, a large amount of time spent on a trip create stressful driving conditions for car owners, generate a whole range of problems, both transport and psychological, environmental, etc.

In order to find effective strategies for traffic flow management and optimal solutions for the design of the road network, traffic management, it is necessary to consider a wide range of characteristics of the traffic flow, patterns of influence of numerous external and internal factors on the characteristics of a mixed traffic flow. Ensuring fast and safe traffic in modern cities requires the use of a set of architectural, planning and organizational measures.

Architectural planning measures include the construction of new roads and transport interchanges, the reconstruction of existing streets, as well as the reasonable design of new urban areas. Let's take a closer look at examples of some of the above measures:

1. Construction of a multi-level road network. This measure consists in the construction of roads in three levels: on the lower – district roads, on the middle – inter-district, and on the top - highways. Most cities cannot implement this method, as it is quite expensive.

2. Since the flow of cars is delayed most at intersections at traffic lights, it is advisable to rebuild the intersection in the form of a river delta and provide one-way passage only to the right in order to rationalize traffic with traffic light adjustments [3].

3. In addition to the traditional expansion of streets due to the roadside lane, it is necessary to carry out the construction of dead-end streets to the main and secondary streets.

4. Modernization of parking lots.

When building yard parking lots, it is necessary to consider the realities of today, i.e., the overload of vehicles per unit area of the city. In this regard, you should not get carried away with the construction of playgrounds and football fields.

Parking lots must be built on the territories of the condominium. During the construction of new houses and commercial facilities, it is mandatory to provide for the construction of underground and multi-story parking lots, for example, office or service. Every office, shop, cafe, other commercial and entertainment and business centers or any other organization located on the main streets should build parking lots and parking lots for employees' and visitors' vehicles at the expense of the allocated land [4].

These measures are certainly important, but in addition to significant investments, they require a significant amount of time, therefore they are not quite suitable as operational measures.

Organizational measures are often the only method of increasing capacity, especially in historically developed neighborhoods of old cities with dense buildings, since they can lead to a temporary, but relatively rapid decrease in the level of traffic congestion of the road network. This group of measures may include the following actions.

1. Popularization and development of public transport. To do this, it is necessary to improve the comfort of buses, ensure their arrival strictly on schedule, allocate separate lanes for public transport.

2. Modernization of taxi services: this type of vehicle must be technically sound and safe for the passenger. Taxis should be cheaper and more accessible than using private transport.

3. Introduction of one-way traffic. Such a measure has already been applied in Astana since 2016.

4. Reverse movement. Before implementing this method, it is necessary to instill a culture of driving a car and strict compliance with traffic rules, since this measure can also lead to the opposite effect due to an increase in the number of accidents.

5. The development of bicycle transport, if the climate allows and there is an appropriate number of people willing.

6. Joint trips or carpooling (Eng. car – car, pool - association). The essence of joint trips is to use the car not only by the driver, but also by several fellow travelers. Many car owners use their vehicle alone, and this measure allows them to save on fuel by transporting passengers. Passengers, in turn, get to their destination cheaper than by taxi and with greater comfort. Carpooling is used both for daily trips along one route, and when traveling to other cities. This method of transportation is common abroad, although this idea can become widespread and contribute to the fight against traffic jams in Kazakhstan.

7. Intercepting parking. Often car owners use personal transport only to get from a remote part of the city or suburb to work, the rest of the time their car is parked. In this regard, the construction of "intercepting" parking lots becomes relevant. Currently, the issue of placing such parking lots as part of urban transport hubs in Astana has not been studied enough. The essence of this event is as follows. For any driver traveling from the suburbs or remote parts of the capital to the central part of the city during the morning rush hour, there are two alternative options for making a trip. The first is traffic on the urban road network by private car, the second is using the intercept parking service and further, by public passenger transport on preferential terms.

The intercepting parking service has several types of tariffs: basic, night and commercial. Basic fare: no parking fee is charged, provided that at least two public transport trips are made from the moment the car is parked. In the case of using taxi services, payment is made at a commercial rate. The night rate consists of paying for the entire period of parking use. Commercial – hourly payment, as when using parking space in other parts of the city [5].

The choice of a driver is influenced by many factors, but the decisive one is the amount of time that is spent on making a trip with each of the driving options.

Thus, when organizing the uninterrupted movement of public transport and convenient conditions for its use, the car owner will give preference to this method of transportation. After all, it is in this case that he will be able to reach the destination in the shortest possible time and for a reasonable fee. Therefore, it is quite difficult to completely solve the problem of traffic congestion. However, with an integrated approach, it is possible to achieve a reduction in the load on the street and road network of the metropolis. One of the most effective organizational solutions is the use of a system of "intercepting" parking.

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