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ELIMINATING AIR POLLUTION IN URBAN CONDITIONS THROUGH THE DEVELOPMENT OF URBAN AND SUBURBAN PUBLIC TRANSPORT SYSTEMS

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The problem of air pollution is one of the most relevant topics in the context of the global environmental problem. Monitoring of the air quality in the city is carried out on major pollutants, including fine particulate matter. The internationally accepted PM10 and PM2.5 coefficients are responsible for this. PM10 includes dust, spores, pollen; PM2.5 includes all gaseous hydrocarbons, nitrogen and sulphur oxides, ozone, ammonia and almost all carcinogens. The concentration of PM2.5 is the number of small aerosol particles with a diameter of up to 2.5 microns. According to the PlumLabs laboratory, the annual average PM2.5 value in Belarus is $9 \mu\text{g}/\text{m}^3$ and PM10 is $11 \mu\text{g}/\text{m}^3$ [1], while the WHO has set the upper limit of the regulatory average concentration value for PM2.5 at $5 \mu\text{g}/\text{m}^3$ and PM10 at $15 \mu\text{g}/\text{m}^3$. Many countries are taking steps to reduce these coefficients in order to improve the climate and environmental conditions of human existence. The largest share of PM2.5 pollutants is accounted by gaseous hydrocarbons, including vehicle exhaust gases and emissions from so-called dirty electricity plants. In the big cities, pollutants emitted by vehicles account for 90% of all emissions, while emissions from factories are just under 10%.

In many cities around the world, decisions have been taken that accidentally or intentionally degraded urban electrical equipment, because of which citizens have become disaffected with its use and consider it inprestigious and uncomfortable. However, since the 1990s, European governments have realized that this was a huge mistake, because in most situations trams are the most cost-effective and environmentally friendly solution in transportation [2]. As a result, tram systems in Europe today are undergoing a real renaissance. Modern trams and trolleybuses can be

fast, comfortable and economical – with the right allocation of priorities in the city [3, 4].

Consider what cities need to do for efficient transport development:

- Any transformation should be complex. Electric vehicles cannot simply replace all diesel cars. The rolling stock cannot simply be upgraded without a review of the route network, tariffs and contractual relationships with carriers, detailed infrastructure development plans, etc. Only a complex approach to transport development and a strategy can ensure high-quality transport services for citizens in the long term.

- Public transport is a social service that the city provides to its citizens and which cannot be fully regulated by free market movement. However, this does not exclude the possibility and even the need for competition in transport – but it should not be the competition of carriers for passenger traffic that leads to dangerous road races, duplication of routes and price wars, it should be a competition between carriers for the execution of municipal contracts for transport work. Thus, the well-organized economy of urban transport is the city's gross contracts with carriers, a single transport system operator, economically sound tariffs, no price competition between modes and flexible tariff policy.

- The city must constantly monitor the transport situation, collecting as much data as possible on the transport. Therefore, the introduction of intelligent transport systems, innovations in transport management are important elements of that model.

- Urban land transport should be given unconditional priority. This is achieved by separating traffic and prioritizing when passing traffic lights. Best international examples of road traffic organizations [3, 4] confirm that transport, which transports hundreds of passengers, must have priority over other modes of transport. It is also necessary to reduce the accident rate with public transport, which affects the stability and predictability of the system. In 2023, there were 161 accidents and 4 water loggings with trams that caused 218 traffic stops in Minsk, i.e. the Minsk tram system experienced a breakdown every 2,212 days, which is not possible when planning a functioning system properly.

- Urban transport should be accessible to low mobility groups, meet the requirements of large and especially large capacity, and comply with environmental, safety and comfort standards for passengers.

- The passenger's desire to reach any destination in a short time and without transfers is clear. The abundance of routes often leads to their ex-

cessive duplication, and therefore unhealthy competition for passengers, congestion, and uneven traffic. The optimal route network consists of trunk routes providing connectivity for agglomeration and auxiliary routes, between which you can make quick transfers without additional charge.

– The city should create conditions for citizens to make a choice of public transport. This implies a whole set of regulatory measures. The first group of measures relates to the rational organization of parking space. The second group of measures refers to services that improve the user-friendliness of transport: implementation of a single e-ticket with the realization of a number of advantages over cash (including lower rate and free transfers), a common tariff menu, electronic and contactless payment, real-time public transport information (within mobile applications and at bus stops), information inside the vehicle. This includes the development of taxis, carsharing and kicksharing, as well as the development of bicycle infrastructure and personal mobility devices as a more efficient way to travel than private motor vehicles.

– The active involvement of citizens in the development of public transport. The practice of a number of cities shows that citizens are ready to actively participate in the discussion of the development of the transport system, make useful proposals, point out shortcomings and development areas. All this is a valuable material for city managers. This also includes transport and residents can achieve impressive results.

Referenses

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