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Ensuring Sustainability of Public Transport System through Rational Management

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Abstract

This paper presents a research of possibility to improve sustainability of public transport system in the city by implementation of management system. Test of proposed method was done using the example of Naberezhnye Chelny. Conceptual model of system as well as interaction scheme of its program modules were shown. The composite indicator to assess system efficiency was proposed. An information-logical model of data as well as process of scientifically based decision making in the sphere of urban public transport routing were described. Such routing approach requires actual information about traffic flows on the city roads and, in the same time, takes into account the minimization of negative environmental impact while keeping index of population mobility.

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Keywords: intelligent transport systems, urban public transport, sustainable development, simulation modeling, transport model

1. Introduction

The rapid development of techniques and technology is a characteristic of the global economy for the new millennium and requires substantial amounts of resources. This leads to a growing number of sources, which provoke a negative environmental impact (Tosa *et al.*, 2015). Besides that, globalization processes of industrial

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production, growing the number and the size of metropolitan regions, which make necessary to organize transportation of passengers and goods, increase also emissions of hazardous substances being disposed of in the environment. At the same time, there is a number of "green" economy supporters, who initiate the development of concepts and policy documents concerning sustainable development in all spheres of human activities (Makarova *et al.*, 2015).The United Nations Commission on Sustainable Development (CSD) formulated the term "sustainable development": it is development, which allows to satisfy requirements of the current generation and does not cause damage to opportunities, which are left for the future generations to meet their own needs (Ambroziak *et al.*, 2014). Ensuring access to goods, working places, services, education and leisure facilities by means of eco-friendly, health promoting, socially and economically viable transport systems is a key factor to improve environment condition and quality of life as well as a factor of economic and social growth (Jacyna *et al.*, 2014). Hence the United Nations Environment Programme (UNEP) together with FédérationInternationale de l'Automobile (FIA), International Energy Agency (IEA) and International Transport Forum (ITF) has launched the campaign "50-by-50", which aim is to improve efficiency of the global vehicle fleet at the least by 50% by 2050 (Rothengatter *et al.*, 2011). One of the ways to achieve this goal is to shift trips from private vehicles to public transport without loss of population mobility. It could be provided by improving comfort and quality of the offered transport services (World Health Organization, 2011), as well as, in a great measure, by improving quality of urban public transport management. International experience shows that the most effective way to increase the management efficiency is its intellectualization, which can be implemented in different ways. Therefore, to increase sustainability of urban public transport, we suggest using the decision support system (DSS). The second section provides an analysis of the global experience and ways to implement an intelligent control. The third section describes one of the ways of traffic management: using the decision support system. Testing of the proposed solution is given in the Section 4.

2. Ways to increase sustainability of transport system in the city

2.1. Priority development of public transport

It was pointed out in the documents of Transport, Health and Environment Pan-European Programme (THE PEP) that there is an amount of positive examples how increasing the share of pedestrian and cycling traffic combined with the use of public transport redistributed the modal split and, thereby, improved the quality of urban environment. These examples include the modernization of cycling infrastructure and urban traffic by using bikes in Paris and Barcelona, fee to enter in the overloaded districts in London, Stockholm and other cities, measures taken in New York in order "to block off traffic" in the strongly overloaded districts and to transform them into parks (Transport, Health and Environment Pan-European Programme secretariat, 2014).

More than 100 countries assumed political measures on the national and sub-national levels to stimulate investments in the public transport. In most of countries with high income level the public transport is regulated in the proper manner and, therefore, is more safety than individual motor transport. On the other hand, in the countries with low or middle income level as well as with developing economy it is not controlled, which leads to growth of accidents across public transport users. Governments must ensure safety, accessibility and affordability of public transport system. The city of Ahmedabad (India) in the year 2010 got the award "Sustainable Transport Development" for successful introduction of the system for a bus rapid transit: buses move on the specially separated lane, bicyclists got also their separate lane as well as pedestrians could use a wide sidewalk. This system guarantees both significant reduction of travel time and increase of environmental friendliness of transportation (level of noise and greenhouse emissions down the street, on which rapid routes pass, are decreased). The system of bus rapid transit built in Columbia (the city of Bogota) plays an important role to ensure the sustainable development of this capital. It is an element of the large comprehensive set of measures, which includes development of sidewalks, pedestrian zones and bikeways, such organizational measures as closing of highways for motor transport during 7 hours each Sunday (it allows to use these streets additionally for walking and cycling), additional 20% tax for gasoline in order to reduce an amount of trips by individual transport (collected money goes towards the development of public transport infrastructure and road maintenance) as well as official weekday without car in February accepted by the full vote (United Nations Human Settlements Programme, 2013).In the year 2014 4 cities were chosen by the Institute for Transportation and Development Policy. These cities were: