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Method of Dynamic Identification of Traffic Flow Conditions According to the Floating Cars Speed Vector

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Abstract

The article considers different approaches to justify the possibility of using actual navigation information obtained from public transportation buses in order to identify a new energy criterion, i.e. speed vector of "floating" cars. Under certain circumstances, this approach would provide both a dynamic evaluation of urban traffic flows and a dynamic redistribution of traffic flows across the network with a course of time, which is a precondition for autonomous vehicle control.

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Main text

The issue of raising road safety and preventing road traffic injuries has become worldwide. The UN believes that a global crisis in the field of road safety had long been in the making and broke out in the world at last. Ironically, to a greater extent, it affected the countries with relatively low level of motorization. The World Health Organization experts say that over 90% of road deaths in the world occur in countries with low and middle incomes of inhabitants, which account for only 50% of all vehicles in the world [Vuchik (2011)].

However, the countries that have long ago reached the peak of satiety of cars per capita suffer other rather acute

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problems associated with another negative side of mass motorization, such as run-out of available urban road networks. In recent years, along with enormous efforts to reduce deaths and injuries at the roads of highly motorized country, it becomes an urgent task to struggle with a lack of parking places and prevention of *traffic congestions* [ECMT (2007)].

Solution of such problems implies coordination of work of all the structures related to traffic organization, starting from driver training centers, organizations developing traffic schemes, logistics and transportation enterprises and their control centers, ending with the executive authorities, local self-governing authorities and health care centers providing primary health care and further treatment of road accident victims. This list can and should be continued. In addition to official organizations intended to transportation and traffic organization, a large number of ordinary citizens who are not always aware of their responsibility to the society during their motorized travels or pedestrian movements are involved in traffic. Therefore, it has long been established that improvement of road safety is a matter of all citizens, and not just officially authorized institutions.

Historically, a fundamental role of this issue in our country was acted by the State Traffic Safety Inspectorate (the GIBDD), which is a part of the National Road Traffic Safety Administration of the Ministry of Internal Affairs of the Russian Federation. According to the currently assigned tasks the GIBDD is inherently an organization performing inspection (from the Latin “*inspectio*”) and control of activities of organizations and institutions involved in preparation and organization of traffic and transportation, as well as engineering and construction of roads. That is why the GIBDD does not possess functional or resource capability to establish a system that ensures safe and, where possible, non-stop movement of vehicles and pedestrians through the urban road traffic network. Thus, along with a constant growth of the motorization level in our country, unfortunately, there is no authority that would be functionally and potentially responsible for implementation of a unified policy control of traffic and pedestrians, especially at the level of urban traffic systems.

Despite a decline in sales of new passenger cars in 2014–2015 and the same forecast for 2016, today’s Russia is still going through a period of intensive motorization. The number of vehicles is rapidly growing, intensity of traffic flows increases in the cities. At the same time, traditional concepts of human mobility and accessibility by transport on any territory are changing. Field investigations held in large cities of Russia indicated annual growth of traffic intensity by 10–15%, while increase of the road traffic network capacity totaled only 5% at most during the same period. Such increase of the capacity was provided, as a rule, at the expense of extension of existing streets, while the issue requires other measures, e.g. increase of the number of road lines (which is almost impossible due to historical arrangement of cities), construction of duplicating streets, increase of links in the road traffic network, distribution of traffic and pedestrian flows into different planes. This lack of balance has been increased over the course of years, resulting in road traffic accidents related to poor conditions and arrangement of road traffic networks, worsening of traffic conditions and the environment, and traffic congestions. The average speed of vehicles within a large number of sections of the road traffic network has declined by almost 40% in recent 5 years. All this suggests that an extremely alarming situation has worked out with organization of traffic of vehicles and pedestrians. Especially it concerns large cities.

Currently, responsibility for urban traffic organization lies on executive authorities. The very concept of “traffic control management” includes a complex of legal, administrative and technical measures. Administrative activities only, i.e. those that are within the limits of the GIBDD powers, cannot solve the problem of traffic congestions. That is why, there is a need to establish new administrative bodies at the level of city administration has emerged; these bodies would provide innovative solutions to accumulated problems of urban road traffic systems.

Such a body should be imposed with the task of creating a “feedback” between traffic organization agencies and the users of the roads and streets. Currently, there are separate departments with their own set of responsibilities. Thus, as it has been already mentioned, the GIBDD controls road traffic users and administrative officers responsible for the traffic safety on different levels. Individual transport companies or their professional associations of various kinds perform their activities according to the existing administrative, legislative and market conditions determined by the level of development of different transportation networks, organization schemes and control systems of the road traffic. At that, the main users of urban road traffic networks are individuals that meet their ever-increasing needs in mobility due to different types of traffic movements. It is well-recognized that mobility has become a key factor not only in the economy, being one of the basic and essential parameters of its growth, but in the everyday life of millions of people. The trend of a growing mobility of urban residents becomes more and more apparent from year to year

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