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**ENHANCING THE EFFECTIVENESS OF URBAN PUBLIC TRANSPORT
MANAGEMENT ON THE BASIS OF LOGISTICAL APPROACHES**

**ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ ГОРОДСКОГО
ПАССАЖИРСКОГО ТРАНСПОРТА НА ОСНОВЕ ЛОГИСТИЧЕСКИХ ПОДХОДОВ**

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Abstract. Study of urban public transport management on the basis of logistical approach today is of high relevance. For a long time, logistical concepts in transport have only been applied in the freight transport field of activities. However, logistical principles might be meaningful for systemic organization and management of civil passenger traffic.

The given paper describes the use of logistical approach and technique in passenger transport, as a logistical chain of operators and infrastructure interacting through logistical links allowing for optimizing the production of transport services, meeting the needs of different population categories through the proper management of available economic resources.

The paper proposes the use of logistical approaches in the systems of urban public transport. They should help to formulate the new principles of management, planning and control over material and their attendant flows, and to become the main competitive advantage in the market of transport services.

Аннотация. Исследование управления городского пассажирского транспорта на основе логистического подхода на сегодняшний день является актуальным. Долгое время логистические концепции на транспорте применялись только в сфере деятельности грузовых перевозок. Однако, логистические принципы могут быть полезными и для системной организации и управления пассажирскими перевозками.

В данной статье рассмотрено использование логистического подхода на пассажирском транспорте, как логистической цепи операторов и объектов инфраструктуры, взаимодействующих посредством логистических связей, позволяющие оптимизировать процесс производства транспортных услуг, обеспечить удовлетворение потребностей различных категорий населения на основе рационального использования имеющихся экономических ресурсов.

В статье предложено применение в системах городского пассажирского транспорта и пассажиропотоке логистического подхода и логистических методов. Они помогут сформулировать новые принципы управления, планирования и контроля за материальными и сопутствующими им потоками, сконцентрированными в пространстве и во времени в системах городского пассажирского транспорта, и стать основным конкурентным преимуществом на рынке транспортных услуг.

Keywords: urban public transport, logistical approach, passenger, travel comfort.

Ключевые слова: городской пассажирский транспорт, логистический подход, пассажир, комфортабельность поездки.

For a long time, logistical concepts in transport have only been applied in the freight transport field of activities. However, logistical principles might be meaningful for systemic organization and management of civil passenger traffic, since the organization of goods and passenger flows has much in common, as well as the differences.

On public transport, goods and passengers use more or less the same transport routes, that is, there are some similarities between planning of systems and process management.

Despite a certain similarity between the processes of the transport of goods and passengers, there are obvious differences.

The main difference is that the passenger appeared simultaneously not only as the object of transportation, but also a consumer of transport services. The passenger plays an active role in the transportation: he is choosing the route and can change it already during the trip. In a sense, it can be asserted that he participates in the organization and management of transport process. Choosing among transportation options depends on a significant number of factors. A list of them does not always coincide with what is taken into account during the development of the best option of the delivery of goods. The passenger can take into account, for example, travelling comfort, the opportunity to drop by the points of his interest on the way, as well as other circumstances that are completely irrelevant in the organization of freight transport [1].

Each group of passengers has its preference, on the basis of which, they choose the route and the travel time, mode of transport, the place of transfer in transport, and method of payment. It is possible to establish a hierarchy among these preferences and make a kind of segmentation of the demand for transport services.

There are contradictions in the interests of the passengers and the carriers, one of which is that the carrier is interested in increasing the shift system factor, but the passenger is interested in direct and fast delivery of goods at their destination.

These differences, despite their importance, are not matters of principle, since in the case of the freight, as with passenger transport, the main task of functioning of the system is to deliver the moveable object from point of origin to point of destination at the minimal total costs, with the established level of transportation quality.

Unfortunately, movement by a private vehicle is associated with adverse environmental effect in urban areas, high fuel consumption, as well as with inefficient use of infrastructure of line transport. Public transport has a particular role to play in the urban transport system, which is essential to the proper functioning of a city from a social and economic point of view. It plays an increasingly significant role in mobility of society, especially in the developed countries, as an effective counterbalance to a growing per capita motorization index, and a tool for reducing the burdensome congestions of the road networks. Thus, in addition to the implementation of a simple function of passenger transport, it is an important factor in enhancing environmental conditions, reducing traffic jams, and also it allows for reducing the investment costs in road infrastructure. It is especially important that the public transport system operates efficiently, is aimed towards the different needs of its customers, as well as for promoting multimodal journey throughout the city.

A multimodal journey is a mixed movement within a single journey by public and private transport. In this context, it is implied that reference is made to the interaction of means of public and private transport in the urban transport system, that is, the integrated transportation when using at least two vehicles. Promotion of multimodal systems in urban areas is the first to limit the problems caused by congestion. Actions taken in this area will allow for improving the travel process by reducing the personal and public costs associated with congestion.

This problem can be effectively solved by using the logistics techniques.

City logistics is a combination of the processes of managing the movement of persons, cargo and information within the city's logistics system, in accordance with the needs and objectives of its development, while respecting the requirements of environmental protection, given that the city is a social organization whose main purpose is to meet the needs of its users [2].

City logistics is aimed at improving the logistics processes in a city. Its central objective is the effective management of these flows in the city between its subsystems, which is implemented in accordance with the principles of balanced development in a way that satisfies at a certain level of the needs of urban users. To achieve these goals, various actions are being taken with regard to the movement of passenger and cargo flows, as well as actions aimed at providing integrated management of traffic environment in a city.

In relation to passenger transport, logistics is a set of design solutions, technical means and organization and management methods, which ensure the target level of passenger service, as well as their safe, reliable and continuous "house/house" delivery at a particular time at minimal cost. The use of logistical approach in passenger transport helps to optimize the transportation process, which is regarded as a logistics system of operators and infrastructure, through the logistical links involved in the process of transport services [3]. In addition, transport logistics allows for smoothing over differences between the goals of the carriers and passengers, as well as between the transport companies under various forms of ownership.

The system of urban passenger transport may be viewed from two standpoints. On the one hand, it works as the sphere of market relations, or the area of interaction of passengers as consumers of transport services and business entities under various forms of ownership, promoting universal accessibility to transport, and the opportunity for urban residents to satisfy their transport needs.

On the other hand, urban passenger transport is an element of social infrastructure, which is essential for city life and implies universal accessibility to transport, as well as the opportunity for urban residents to satisfy their transport needs.

The functioning of the urban passenger transport system in logistics infrastructure of municipal economy is primarily aimed at ensuring the high quality of transport services whilst minimizing the budgetary costs.

The use of logistical approach in passenger transport, in which the urban transport complex is being viewed as a structured system, and the transportation process — as a logistical chain of operators and infrastructure interacting through logistical links, allows for optimizing the production of transport services, meeting the needs of different population categories through the proper management of available economic resources.

The essence of logistical approach in organizing the work of urban passenger transport (UPT) is that it is considered to be an intraproductive logistics system at the macro- and micro-levels [2, 4]. At the macro-level, urban passenger transport works as the elements. They provide rhythm of work of these systems, and besides, they are sources of material services — transport services.

The basic feature of the use of logistics techniques in the management of urban passenger transport at the present stage is the varied nature of services and forms of organization of urban passenger transport infrastructure.

Logistical approach to building up a technical infrastructure of urban passenger transport is to provide the shortest links between the main passenger-generating points [5–6], in equipping these points with necessary facilities, accounting of the volumes of passenger traffic and the requirements for comfortable passage in the calculation and selection of the optimal rolling stock and types of transport means.

Along with the traditional tasks of organizing the work of UPT, such as providing communication between the city's districts, ensuring regular traffic and increasing the density factor of the route network due to its even distribution across the city's territory, it is appropriate to emphasize other logistical problems as well. These problems are as follows: the routes should connect the starting and ending points of passenger traffic on the shortest distances; the number of rolling stock units and the operating mode of transport should be such that the delivery of passengers to the destination is timely.

The presented logistical problems do not coincide with the traditional task of ensuring a minimum time interval of traffic within 24 hours.

Thus, in order to use logistics techniques, the passenger flows should be concentrated in space and in time, that is, they must be characteristic of stable technological linkages.

Since all types of passenger transportation may not possess such characteristics, the universal application of logistical approach to the organization of transportation of urban residents could not be expected.

To introduce logistics techniques of management, the most perspective are the following categories of the correspondences of urban residents [7]:

- trips for the purpose of work from the areas of mass housing construction to large enterprises and organizations, or to the zones of concentration of several enterprises (industrial zones);
- trips to the summer house and to the locations of out-of-town recreation;
- night trips from train stations and from entertainment centers;
- travels relating to connected with mass entertainment events (city festivals, etc.);
- travels from train stations to the passenger-absorbing zones, and from the areas of compact settlement (from the housing complexes) to train stations.

Even though all trips belong to different groups of a generally accepted classification (forced and voluntary, regular, seasonal, periodical, one-time), they all have spatial and temporal characteristics, that is, they are fixed in time and focused on the areas. In addition, in all of the above cases, it is necessary to transport a significant number of passengers on routes as soon as possible, the starting and ending points of which are relatively few and rather clearly defined.

Thus, the urban passenger transport management systems can be divided into two groups according to the principles of their functioning: traditional and logistics groups.

Traditional one provides travels of urban residents between the evenly and randomly distribute city destinations.

Logistics group provides mass correspondences of passengers, who have a common purpose of travel. Such a system of passenger transportation is similar to the logistics systems like “Just in time”: “between the fixed areas of the city at a fixed time or time interval”. Accordingly, the main purpose of using logistics in the UPT systems is to guarantee non-stop travel, improve management of information flows, reduce environmental pollution caused by road transport.

It should be noted that the use of logistical principles in the field of public passenger transport is well reasoned, since it involves the formation of all flows, the management of which is handled by logistics. Namely:

- Material flow formation — rational use of material resources;
- Financial flow formation — further adaptation of public transport;
- Service flow formation — ensuring high quality of passenger service.

Logistical approach to the management of passenger flows requires the integration of individual participants in the transportation process into a single system able to provide the population with quality transport services with minimal time and material resources. As the prospective aims to optimize the operation of passenger transport within the framework of logistics systems, there can be singled out the following [8–9] ones: providing an integrated approach to the development of regions and urban areas and their transport systems; justification of the structures of transport management influencing on the formation of transport systems and taking into account the interests of the population; development of principles and methodology for providing the regional transport system with rolling stock and modern technologies, taking into account economic and environmental aspects; development of methods for increasing the level of transport services for the population.

City logistics emerges as a response to the need for optimizing flows within the city limits. Its application in the field of movement of persons and cargo allows for optimizing all movements and reducing such a dangerous phenomenon as traffic congestion. Activities in this area contribute to maximum satisfaction of the requirements of urban consumers, reduce time and cost of travel, and simultaneously the enhance urban development of cities, which is a matter of priority.

The use of, for example, the urban distribution centers for the purpose of the movement of goods, or using the multimodality concept for the purpose of the movement of passengers, as well as the mobility centers common to two modes of movement, offers a number of opportunities to organize them.

It must also be taken into consideration that the constant increase in the road network may not necessarily facilitate such a negative phenomenon as transport congestion. Thus, it is necessary to introduce new modern technologies using in transport telematics.

These technologies can be applied throughout the country, creating the so-called universal intelligent transport architecture, which arises from the intelligent transport systems.

Thus, it can be concluded that the application of logistical approach should help to formulate the new principles of management, planning and control over material and their attendant flows in the UPT systems, and to become the main competitive advantage in the market of transport services.

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