

EFFECTS OF TRANSPORT FLOWS ON CITY PASSENGERS

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Annotation: The transport sector around the world is changing rapidly, and until recently, the main hypothesis of the local passenger transport community was that the existing modal landscape of cars, buses, and taxis could not be imagined to develop as it does now. This article presents proposals and solutions to problems related to passenger transportation, traffic flow management, and effective organization. It was also analyzed internationally through Vosviewer.

Keywords: transport, passenger transport, public transport, education, system.

Introduction. The current period is characterized by the rapid development of cities, improvement of improvement works, and a sharp increase in the number of city residents. In such conditions, providing high-quality transport services to city residents requires further development of urban passenger transport and the development of new and more efficient modes of transportation [1]. The organization of road transport in the city transport network has its own characteristics. It should be noted that the main complexity of managing passenger transportation processes in cities is the uncertainty in the formation of transport flows [2,3]. The impact of most factors affecting the size of passenger flow is changing over time and has a probabilistic character.

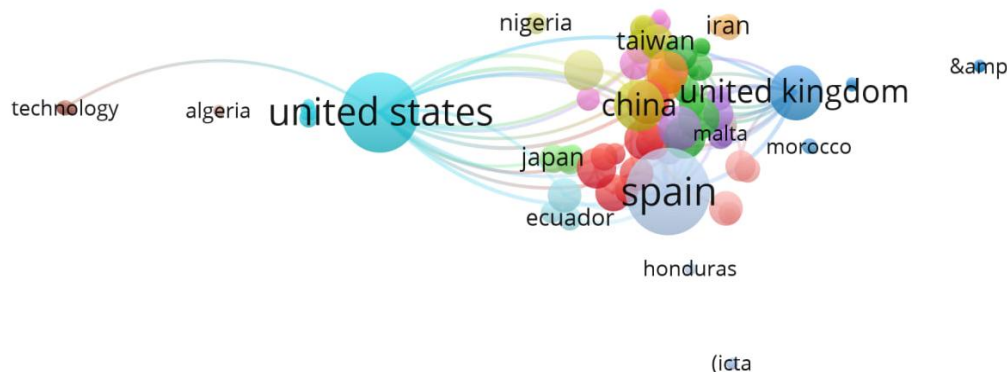


Fig. 1. Countries engaged in urban passenger transport

The multi-phase study was based on individual in-depth interviews with 50 senior local passenger transport operators, government officials, lobbyists and experts from New Zealand and around the world; and four validation workshops with 28 sector stakeholders [4].

Methodology. The data was analyzed using mostly pre-determined themes from which four scenarios were constructed and then validated. The implications are that the local passenger transport system is about to transition to a system of shared mobility; public transport will need to evolve to remain relevant but will remain important in any scenario; and the role of the government will be vital in overseeing the transition to the era of shared mobility. These lessons are now being used to inform transport and broader policy decisions across New Zealand [5]. Overall, the study is the first to apply such a global and qualitatively rich dataset to view the long-term future local passenger transport system as a whole.

Much has been written about the accelerating pace of societal and technological change, but until recently, such statements were not typically applied to the public transport sector. Indeed, the operational concept underlying the bus (i.e., large vehicles on fixed routes and operating on fixed schedules) has not fundamentally changed as a concept since its introduction almost 200 years ago (Agarwal et al., 2019; Vuchic, 2007; Potter et al., 2019). However, there is growing evidence that this perspective is now beginning to change, with several recent reports emphasizing the need to understand the changing mobility landscape and its implications for the public transport sector. Thus, the UK government policy paper, *The Future of Mobility* (GOfS 2019), proclaimed this to be "a time of unprecedented change in the transport system," while KPMG's *Mobility 2030* study reported that technological innovation will "completely disrupt" the mobility ecosystem within a decade (KPMG, 2019).

In response to this situation, in August 2015, the New Zealand Ministry of Transport (NZMOT) commissioned the *Public Transport 2045 (PT2045)* study to consider how different local public transport futures might affect society over a 30-year time horizon, and how governments might best respond to ensure the "best" possible outcomes. The latter goal reflects the strong influence that transport systems have on the viability of cities. A role for policy makers during a technological and behavioral transition is to envision the types of places their citizens can live in and to shape the involved urban transport systems. The purpose of this paper is to present the results of this study.

Result and discussion. The formation of passenger flows is also influenced by time of day, days of the week, and seasons of the year.

The demand for urban passenger transport services can be estimated based on the study and analysis of passenger flows. To a certain extent, the study of flows can also provide information about population movement between different territorial districts, areas, and addresses of the city territory. Flows arise from the need for passengers to move around the city.

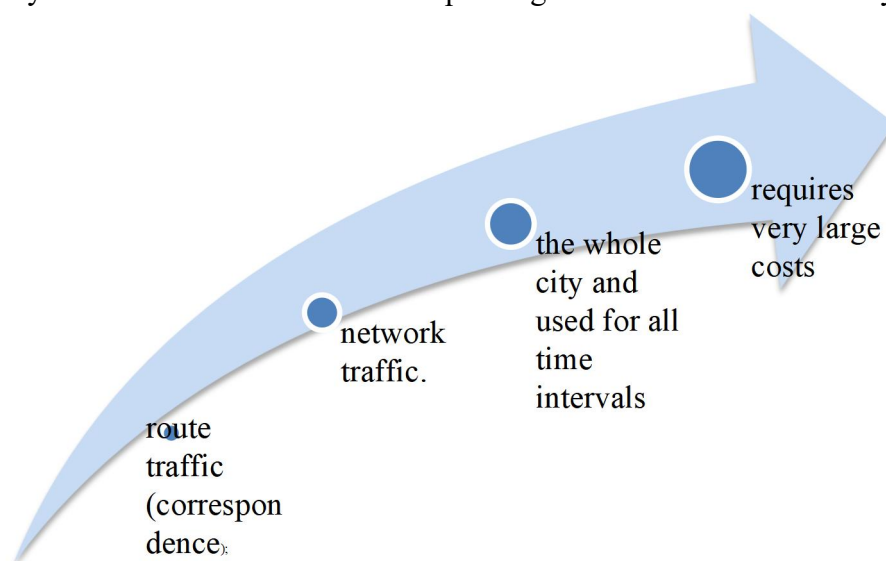


Fig 2. Passenger traffic types.

Although there are currently many methods for monitoring and analyzing passenger flows, the following two disadvantages are common to all of them:

1) the study of passenger flows is carried out in a certain area of the city at a certain time interval, however, the results obtained in this case are generalized to the whole city and used for all time intervals;

2) the studied situation belongs to the past, but its results are used for future solutions. In other words, the studied passenger flow is the result of the actual fulfillment of transport demand in the past, and the expected flow in the future may differ from it;

3) The study and analysis of flows is a very labor-intensive activity (thousands of man-hours), which requires very large expenditures. The problem can be solved through mathematical models that reflect the relationship between the expected volume of transportation in the future and the factors causing the movement of the city's population. It is important to consider the factors of the following three groups that shape the transport mobility of the population when determining the future size of passenger flows (Figure 1):

The first group of factors allows us to characterize the conditions of passenger transportation: city planning and planning; location of residential areas, cultural recreation areas, trade centers and industrial enterprises, field yards; location of road networks and infrastructure; observed time - season, month, days of the week, hours of the day, etc.

The second group of factors characterizes the population's demand for passenger transportation. The segmentation of this demand depends on the social and professional structure of the city's population. This largely depends on their requirements for the price of the transport ticket, speed of movement, convenience, reliability, and safety. The indicator of passenger demand grouping for urban transport can be a socio-economic assessment of the time spent on their movement.

The third group of factors is explained by the competitive environment of urban passenger transport. Carriers with various forms of organization and ownership participate in the urban transport services market: joint-stock companies, limited liability companies, or private entrepreneurs, etc.

The activities of urban passenger carriers are carried out within the framework of current legal and regulatory provisions and under the control and influence of the city authorities. Management of passenger transportation processes in the city is the effective satisfaction of the population's needs based on the effective planning and management of passenger flows and the delivery of relevant information from destination to destination. The purpose, objectives, and indicators of planned transport services are determined by the population's transportation needs. The logistical goal of public transport activities is to minimize total costs while being able to fulfill the tasks of providing services to the population.

The criteria for providing transport services to the population are determined based on the extent to which the requirements for the volume and quality of transportation must be fully met. For example, it is necessary to ensure the precise implementation of the established action schedule. The higher the requirements for the service level, the higher its price. But price itself cannot be an objective function, so a certain compromise must be found. The main problem in determining the purpose of transport services is the need to take into account all the interests of society. In doing so, we should not limit ourselves to considering the interests of vehicle owners or public transport companies.

In this regard, it is necessary to take into account the implementation of the following stages in order to achieve the goal based on the formation and application of a strategic logistics management model of passenger transportation processes in the city:

Stage 1: the political and social goals of the city management bodies to improve the quality of passenger transportation processes in the city and justification of ways to achieve them;

2nd stage: to determine the factors affecting the criteria for the population's choice of means of transport in the city, to influence these factors in order to increase the convenience of urban passenger transport;

Step 3: determine the costs necessary to ensure the development trajectory of the logistics system, compare them with existing opportunities, and, if necessary, identify sources of additional opportunities.

Based on the implementation of the above steps, the necessary levels of indicators of the impact of passenger transportation services on traffic safety will be determined.

The following can be indicated as such indicators:

- 1) walking distance to the stops of the passenger transport route;
- 2) operational qualities of the passenger transport vehicle (capacity, ease of walking, etc.).

Regardless of the ownership of the buses, they mainly run on pre-determined routes and provide transport services to the population.

The concept of route plays a crucial role in defining and resolving issues related to organizing and managing passenger transportation processes. In short, it is necessary to implement the political and social goals of the strategic logistics management model of passenger transportation processes in the city. The analysis shows that the importance of transport in the private sector is growing day by day. The main reason for this is the creation of various forms of private ownership, the adoption of laws and decisions on the development and protection of small and medium-sized businesses, and the creation of conditions for free competition between them and their legal protection.

The transport system is about to transition to a system of "shared mobility." Three of the four scenarios envision futures in which private car ownership has drastically declined because alternatives have developed that people find more attractive. So, in 'Shared Shuttles', increasing urban density makes it easier for many people to access work, education, recreation, and friends or

Conclusion, this work is original because it is the first study to take such a broad view of the long-term future passenger transport system while using such a qualitatively rich and globally diverse set of interview and workshop data. Specifically, the study draws on 50 in-depth interviews with practitioners from New Zealand and around the world, the results of which were then validated in four workshops attended by a total of 28 practitioners.

Due to the fact that the questions posed in this study were primarily intended for a government study, survey respondents were assured that raw data would remain confidential and would not be shared.

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