Public Urban Passenger Transport as Important Factor in the Development of Cities

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***Abstract*—In the year 2007, it has been statistically noted, that the number of persons living in the cities has exceeded 50% globally. In accordance with this trend of growth of city residents, by the year 2030, 6 out of 10 people will be living in the cities and this number will increase to 7 out of 10 by the year 2050. The questions of optimal functioning, sustainable growth and quality of urban life are now more important than ever and the city traffic system has a crucial role in it. The optimal contribution of the city's traffic system in the functioning and development of the city, especially with the expansion of its population, is only possible by acquiring the technical, technological, organizational and compatibility and complementarity of the transport systems in supplying the demand for transport.**

***Index Terms*—city traffic system, compatibility, complementarity of the transport systems, growth, development**

I. Introduction

Today, the cities are home to more than 50% of the world's population. The urbanization of the human population is a constant and an unstoppable process, which demand that ever more difficult challenges from the cities transport system be met. The constant growth trend of the urban population is an important factor of development of the human civilization. The cause of such intensive process of urbanization can be found in the human being itself, as a social being, it experiences an ever increasing development through the community and its synergy (see Fig. 1). With the increase of the size of the cities, the complexity of their functioning also increases, for example, life in a two-times bigger city usually brings a higher standard of living (the consequence of a more intensive economic activity) shown by a 15% higher salaries, but also requires additional 15% more hiring of police personnel because of 15% more crime etc. Life in a bigger city also implies a higher average speed of pedestrians due to a more dynamic city life.

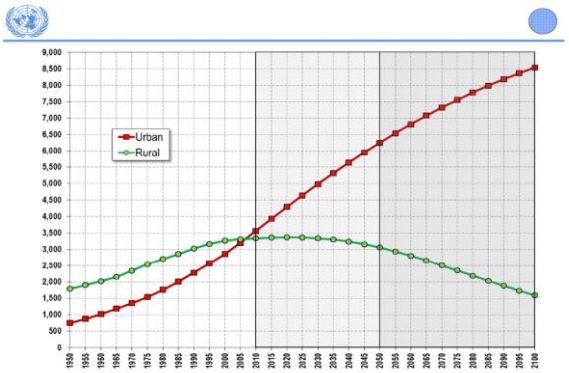

Figure 1. World: Urban and rural Population 2010-2100. (Source: United Nations, Department of Economic and Social Affairs, Population Division (2012): World Urbanization Prospects, the 2011 Revision. New York)

Urban passenger transport represents the basic assumption for the functioning of urban agglomerations, since it facilitates normal social functioning and smooth economic development. [1] Public urban passenger transport forms an exceptionally significant service enabling normal social functioning and undisturbed economic development. According to Banković, the increase in the size of cities results in an increased need to include an increasing number of subsystems of public urban and suburban passenger transport. [2] This means that it is important to achieve full integration and coordination of active subsystems into the system of public urban and suburban passenger transport in order to realize synergic effect of optimal functioning of an integral transport system in meeting the demands for transport services. [3] In the functioning of a system of urban passenger transport particular emphasis is on the technical and technological compatibility of its subsystems, and mutual organizational and tariff harmonization. It should be noted that there is strong connection of the realized or desired level of quality of the transport service and its price, and that the traffic system affects directly the efficiency and effectiveness of the economic and overall social system. [4]

Along with the growth of the city the significance of the city's traffic system also grows proportionally for its

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normal functioning and intense economic development. The city's traffic system can often be compared to (especially when the subject of the matter is a metropolitan area with large cities with multi-million population) a "global" traffic system of its own kind, so it is necessary to observe its functioning and development from the perspective of a integral traffic system as a whole. The efficiency of the transport system (shown by the number of transported passengers or executed transport work in a unit of time) and the business efficiency (shown as a financial result) is necessary to observe and analyse within each transport system. [5]-[10]

The necessity of an integral approach to the functioning of a city traffic system comes from the complementarity of transport systems which function within other systems, because of their different technical and technological attributes and accordingly different transport capabilities, environment effect and the concept of sustainable development of each transport system. [11]

The basic factor in the process of modeling of management and development of the traffic system is the existing and forecasted demand for transport which is met by engaging certain transportation systems. [12]

II. Complementarity and Compability of Transport Systems in the City's Traffic System

The traffic system consists of all the traffic sub-systems, that is transportation systems which are in function in a certain space and time. The purpose of the traffic system is to enable the functioning of the people's community, as in its normal functioning and also its undisturbed and as quick as possible total social development.

The goal of the city's traffic system is to meet the demand for transport which exists in its area with the appropriate transport supply of a certain quality of service.

Figure 2. Metro, rail, tram, taxi and bus stop in the public transportation system of the city of Lisbon[1].(Source: author, Lisbon, March 2012).

The compatibility of transport systems of a certain traffic system is realized in all of its subsystems, first of all its technical, technological, organizational, economic, legal, and ecologic subsystem between transport systems in a certain space and time. In the passenger traffic, the compatibility is realized through joined terminals (a single point enables direct transfer of multiple transportation systems), information about transport lines and the compatibility of arrivals and departures of transport vehicles which enable the continuation of the journey without waiting, compatibility of tariffs and if possible the price of tickets (see Fig. 2, Fig. 3, Fig. 4, Fig. 5, Fig. 6, Fig. 7, Fig. 8).

Figure 3. Transport terminal in Lisbon – a joined point of rail, road, bus, metro and taxi transport system. (Source: author, Lisbon, March 2012).

Figure 4. Transport terminal in Lisbon – a joined point of railroad, bus, metro and taxi system – bus platforms. (Source: author, Lisbon, March 2012).

The compatibility of transport systems is a basic assumption of optimal contribution to the city's traffic system in its functioning.

Cities with elaborate public passenger traffic, depending on different factors (geographic location, historic circumstances, terrain configuration and the level of city's development), have multiple traffic subsystems existing at the same time.

Scientific problem is oriented on analyzing the harmonization of relation between the traffic values from the area of traffic supply and the trends and dynamics of passenger transport demand indicated by the number of transported passengers in the system. Traffic planning is determined by the need for continuous increase in the capacities of the traffic system in order to satisfy the increase in the transport demand.

The focus of attention of the transport planners and managers is not just to anticipate and insure the necessary traffic infrastructure and superstructure, but rather also its maximal usage with priority recognition of the transport service users' requirements.

[1] The ground level is used by tramways, buses and taxies, the stops are linked on the ground level to the rail (city and intercity passenger transport), road system, the metro system is located on levels -1, -2 and -3 below the ground level.

The transport modeling often represents a significant part and basis of the business decision-making process in the optimization of the transport system.

The dominant transportation system in cities with up to 100.000 residents is the bus transportation system, with the increase of city's size and thus a greater transport demand, due to the limited capability of the bus transportation system, the dominant system becomes the city's tramway transportation system. After the tramway, in cities with more than a million residents, the city's metro system is the primary transportation system. In every city, all of the present transportation systems act together in supplying the demand for transport.

The complementarity of transportation systems which function within the public transportation system (hereafter: PTS) is the most important assumption and requirement in creating a sinergy which the system offers to its residents as a whole.

Figure 5. Transport terminal in Lisbon – a joined point of railroad, bus, metro and taxi system – the connection of bus and metro transportation system. (Source: author, Lisbon, March 2012).

The transportation systems which exist in a certain city acomplish their complementarity by, first of all, their technical, technological, organizational and economic compatibility.

Figure 6. Transport terminal in Lisbon – a joined point of railroad, bus, metro and taxi system – platform for arrivals and departure. (Source: author, Lisbon, March 2012).

The technical compatibility is comprised of, for example, use of joined infrastructure, or in the points of connection enable a fast, secure and simple transfer of passengers from one to the other transportation subsystem (see Fig. 3, Fig. 4, Fig. 5, Fig. 6).

The technological compatibility is comprised of joined technological factors in terms of preparation, execution and ending the transport process (joined devices for ticket purchase, safety of passengers, frequency of departures, comfort level, accuracy, speed), and also of supplying the transport demand in the exchange of transportation subsystems (see Fig. 7).

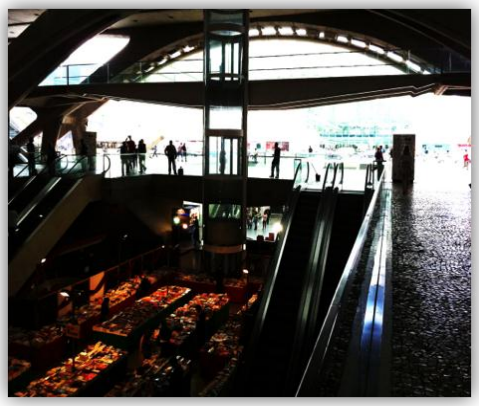

Figure 7. Transport terminal in Lisbon – a joined point of railroad, bus, metro and taxi system – the connection of road and metro system. (Source: author, Lisbon, March 2012).

Figure 8. Schematic of metro lines in Lisabon (four lines). (Source: author, Lisbon, March 2012).

The organizational compatibility consists of spatial (points in which the exchange of transportation systems occurs) and time coherence of complementary transportation subsystems. The economic compatibility is present in a unique tariff system within the PTS, and the price of the service which is stimulating enough in relation to individual transport (see Fig. 8).

III. Conclusion

An integral approach to modelling and managing the development and functioning of the city's traffic system comes from the complementarity of the existing transportation systems. A significant factor in all of this is the influence on the environment, that is the application of concept of sustainable growth of each individual tranpsort system. If the necessity of an integral approach is accepted in analyzing, functioning and contribution of the traffic system considering its purpose of supplying the demand for transport, then the requirement for

compatibility between transportation systems become significant. The basic factor in the process of modelling of management and development of the traffic system is the existing and forecasted demand for transport which is met by engaging certain transportation systems. An important criteria of dimensioning an individual transportation system is the required level of transport service quality. Practice shows that each transportation system has its place and significant role in the functioning of an integral traffic system, so except for the competition that is always present between them, their complementarity is most important for the system as a whole to fulfill its mission of supplying the demand for transport with minimal total average cost per transported passenger and with the appropriate quality of the transport service.

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