

# The problems of urban public transport and their solution trends

J. Butkevičius & L. P. Lingaitis  
*Vilnius Gediminas Technical University*

## Abstract

Communication necessity is determined by the need to meet an urban resident's business, cultural and everyday needs. The population movement in Lithuania's biggest cities, Vilnius (570.000 residents) and Kaunas (373.000 residents), constitute 3.0 and 2.5 trips a day respectively. 50 percent are made up of business trips and approximately 40 percent of all these trips involve changing transport means. 45 percent of the trips in Vilnius are made using public transport and 25 percent by means of car; in Kaunas these numbers equal 60 percent and 22.5 percent respectively. The research carried out by the author highlights the following main urban public transport problems: public transport has lost its attractiveness, the majority of resident's business trip length exceeds the set length, a slow communication speed which diminishes more in the city centre, public transport means that have undergone wear and have grown obsolete, public transport means are not equipped to satisfy disabled people's needs, a poor financial state of public transport, public transport has not been given priority rights either at crossroads or in the streets, an imperfect public transport management system, the development of the public transport network in many cases is not based on academic scientific research, an inadequacy of coordinating the work of various public transport means a fare system does not meet modern requirements.

*Keywords: urban public transport, a trip, traffic movement, scientific research, network, trips, carriers, clients.*

## 1 Introduction

Public transport is the most important one in the system of urban trips, since its effect on the infrastructure as well as the environment is significantly smaller



than that car have. Besides, this transport performs an important function as it carries the biggest part of urban residents on dole.

The author has put forward the comp lese of the development of urban public transport means, the main of which are as follow the optimisation of the network of all kinds of passengers transport on the basis of research, the competitive route service, the implementation of legal relations between carriers and clients, investing public transport with priority rights in the whole urban communication system, the implementation of “Park and Ride” system, the introduction of separate lanes meant for public transport, etc.

## 2 Forecasting of passenger transportation development

Considering passenger traffic, a problem of forecasting the development of this transportation sector closely related to other areas arises. In developing econometric models a researcher is usually faced with a great number of variables and a small number of observations. If only some of them are considered, the obtained data will not be correct. Therefore, one of the most suitable approaches may be the application of multiple regression analysis. In general, an assignment of forecasting is formulated as follows: let  $Y = \{y(t_i)\}$  – one-dimensional time sequence of statistical observations  $t_{i+1} \div t_i = \text{const}$  in time moments, where  $i = 1, \dots, n$ . The task is to find the values for a certain period  $T$  in the future, i.e. the values for the time moments  $t_j$ , where  $j = n + 1, \dots, n + T$ . In addition, keeping a general trend unchanged in time may the inertia of the investigated process be considered.

The equation of a time sequence for the time moment  $t$  may be calculated as a sum of two components:

$$y = f(\Theta, t) + \varepsilon(t), \quad (1)$$

here,  $f(\Theta, t)$  – a certain constant time function (trend);  $\varepsilon(t)$  – a random function taking into account the effect of irregular factors;  $\Theta$  – the parameter vector to be evaluated.

$f(\Theta, t)$  characterizes major trends of the process considered, assessing their effect on the process. This means that if we find  $f(\Theta, t)$  which is a constant part of the process, then  $\varepsilon(t)$ , the remaining part, would be a random quality. Then, it will be proved that such a process is stationary.

To determine  $f(\Theta, t)$ , the regression and correlation analysis is used.

If there is a relationship between the variables  $t, x, z$ , for example,  $t$  – time periods,  $x$  – gross national product (GNP),  $z$  – national income and  $y$  – number of passengers, then, if a relationship exists, we get:

$$y' = at^2 + bt + cx^2 + dx + ez^2 + fz + g. \quad (2)$$



When the regression parameters  $a, b, c, d, e, f$  and  $g$  are calculated, a system of seven equations is solved.

The calculations show that national income is the most suitable parameter for making passenger traffic forecast, compared to other parameters including gross national product, monthly work payment, household income and expenditures, national wealth, production and users' cost index and variation of consumer goods and services.

In all regression equations used in forecasting,  $t_i$  is time factor and  $x_i$  – national income factor.

The following equation was used to make a forecast for transportation by bus in the city:

$$y = (-8.8611E - 7)t_i^2 - 11.76028t_i + (2.222E - 7)x_i^2 + (4.1159E - 16)x_i + 5.24 \quad (3)$$

The regression equation for a forecast of passenger transportation by trolleybuses is as follows:

$$y = (-8.5873E - 8)t_i^2 - 9.5879t_i + (2.4992E - 7)x_i^2 + (4.1149E - 16)x_i + 3.8 \quad (4)$$

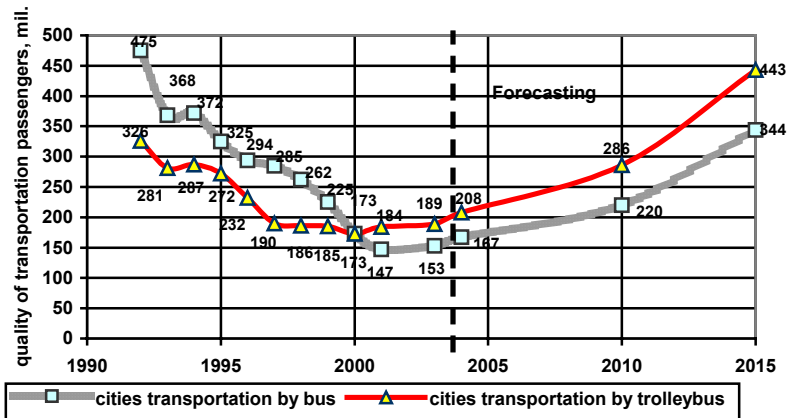


Figure 1: Urban passenger transportation.

As it can be seen in Fig 1, it is predicted that by 2010 urban passenger transportation by bus and by trolleybus will grow up to 220 m and 286 m passengers, respectively (compared with the number of passengers transported in 2003 it will grow by 1.4 and 1.5 times, respectively), while by 2015 it will increase to 344 m and 443 m people (compared to the figures for 2003 it will grow by 2.2 and by 2.3 times, respectively).

### 3 Providing public transport the status of social transport

Road passenger transport for public use (further, public transport) includes buses (trolleybuses) to carry passengers on fixed routes, with payment reduced for this kind of transportation under the provision of law.

Public transport is of particular importance for society because it provides a possibility for people to get to work as well as to educational, medical, cultural institutions or some other places on business or for entertainment.

This kind of transport is most commonly used by socially supported or not well off people. According to the law on transport payment, some groups of Lithuanian citizens have the right for 80 % or 50 % reductions in charges for road passenger transport, while children under seven years can travel free of charge.

Therefore, based on the above considerations, public transport should be provided the status of social transport.

Moreover, the laws stipulating that public transport services satisfy the needs of the inhabitants, including socially supported people (i.e. handicapped, old people and students) should be developed.

#### **4 Creating a legislative basis for public transportation**

To secure the availability of public transportation, the particular regulations concerning the provision of public services should be developed.

The responsibilities in delivering public services imply that governmental institutions or their representatives, municipalities and carriers take a responsibility to provide the carriage of passengers on fixed routes in volumes and on conditions determined by the government, its representatives or municipalities according to the agreement with carriers (transport services providers).

The delivery of public transportation services involves the following responsibilities of customers and service providers (carriers): customers are responsible for organizing public transportation and paying the carriers for the provided services according to the agreements signed with them, while the carriers take a responsibility to provide passenger transportation on the routes with tariffs fixed by customers and satisfying other requirements of the latter.

It should be noted that only the carriers having a particular licence, as well as licensed buses and winning a bid for operating on a particular route(s) while having a special permit to service this route may take the responsibility for providing public transportation services.

#### **5 The priority of public transport over personal cars**

In order to reduce traffic and passenger flows as well as avoiding traffic jams, increasing safety on the road and decreasing a harmful effect of transport on the environment, the inhabitants should be encouraged to use public transport rather than personal cars frequently (especially for going to work). The advantages of public transport over personal automobiles may be demonstrated by these examples:

- a. According to the calculations of the International Road Transport Union (IRU), a bus is capable to carry as many passengers as 30 cars. In this country, a car usually carries to work about 1.7–1.8 passengers, while a double



(blocked) bus can carry about 200 passengers in rush hours. In terms of the occupied area on the road (dynamic clearance) a blocked bus is equal to 4 cars which carry 7 passengers. A bus, however, can carry 200 passengers.

This implies that the priority should be given to public rather than personal passenger transport because, in this case, traffic, accident rate and harmful environmental effect would be reduced.

## 6 Creating equal bidding conditions for carriers

Traffic routes should be treated as goods to be offered to transport operators on the conditions most favourable to customers. According to the EU requirements, all regular transport services should be profitable. In addition, a bid for getting a contract should be organized.

In order to ensure fair competition for getting the right to provide public services, the carriers should be chosen in a bidding.

In cities with more than 100 thous. inhabitants, bidding for providing bus services is usually arranged by transport agents – Transport Board in particular, in other towns and regions it is the responsibility of municipalities or their transport agents.

At the initial stage it is rational to give the priority to currently operating transport organizations.

All carriers should have the same working conditions irrespective of the status of their enterprise.

Developing and upgrading the network of routes and bus schedules, a principle of not ruining the carriers should be followed.

If the requirements of passengers are not met on some routes, a competent institution should optimize traffic schedules or increase the number of vehicles and offer the carriers to work under these new conditions. However, the financial interests of carriers should be taken into account when schedules are changed. With respect to carriers there should not be profitable and unprofitable routes.

A bidding should be arranged when:

- b. a competent institution has established a new route;
- c. a competent institution is going to extend an existing route, while the current service provider does not agree to work there or cannot service it for some reason;
- d. a competent institution is going to change the route, or the location and the number of bus stops on this route, while the current service provider does not agree to continue working under such conditions;
- e. the number of vehicles on a particular route should be increased, but the current service provider cannot afford it;
- f. several operators provide transportation services on the same route, but a competent institution has claims on their joint operation;
- g. a competent institution abolishes the permit for providing transport services;
- h. the provider of transport services refuses to work on an existing route;
- i. the time of validity of service provider's licence expired;



The bids made by transport service providers should be evaluated from the following perspectives:

- j. bidder's claims for annual financing ;
- k. technical state, age and comfortability of vehicles and their suitability for working on a particular route;
- l. experience of service provider;
- m. standard of services provided to passengers;
- n. service provider's performance over the previous year and the year of bidding if the bidder provided passenger transportation services before bidding;
- o. an offered ticket system;
- p. available bus depots and repair shops;
- q. availability of equipment to inspect vehicles before going on route;
- r. a system of registration and control of driver's work and relaxation hours;
- s. drivers' health control before starting the work;
- t. meeting the environment protection requirements by the company providing transport services;
- u. prospects of transport company's development and extension.

A bidding for only one route may be arranged. However, it is more rational to join routes according to the direction of travel, its urban or suburban character, etc. arranging biddings for packages of routes. Profitable and unprofitable routes may be grouped in different packages ensuring equal conditions for all transport service providers.

Biddings arranged for transport service providers allow for considerable reduction of financing because, usually, the lowest bidder is selected. If biddings were arranged for all regular local routes in Lithuania, tens of millions of litas could be saved because the lowest bidder would be chosen (also making account of other factors, e.g. vehicle age and comfortability, modern implements as well as experience of service providers, standard of provided services, etc.).

Biddings could also provide an opportunity to private carriers to enter the market in a natural way because the cost of transportation by their vehicles is usually lower than that of a large bus park and they may be the lowest bidders who could win the contract.

## **7 Providing a contractual basis to the relationships between customer and carrier**

The relationship between customers and carriers should be based on legal grounds as required by the European Economic Council. Therefore, provisions should be made that carrier could take the responsibility for providing public services according to the contract signed by transport service customer and carrier selected in bidding.

The contact on public services provision should include and specify the following issues:

- 1) a list of routes, bus (trolleybus) schedules on particular routes, size and capacity of buses (trolleybuses) used, traffic regulations, the number of runs and kilometres logged;



- 2) passenger transportation tariffs (fares);
- 3) the process of financing the carrier for the provided transport services;
- 4) the responsibility of carrier to provide statutory tariffs with discounts for passenger transportation by public transport which are granted by municipalities;
- 5) the responsibility of carrier to quickly replace a vehicle broken on the route by a serviceable one;
- 6) the responsibility of carrier to take account and make calculations of vehicle operation on regular routes determining basic economic indicators (i.e. cost of carriage, expenses, etc.), and providing the reports to customer as required;
- 7) the responsibility of carrier to keep to the fixed order of work and relaxation;
- 8) the responsibility of carrier to provide basic data on the licensed operation to a competent institution as required;
- 9) the responsibility of customer in financing the carrier to take into consideration the criterion of profitability needed for renewing the park of vehicles in due time;
- 10) sanctions for customer and carrier for not keeping to contact clauses;
- 11) other provisions according to the agreement between customer and carrier.

A competent institution authorized to give the permit to carry passengers on fixed routes should make a contract with a bidding winner. When carriers and customers (competent institutions) sign the contract their mutual relations are legitimized. This implies that the responsibility of carrier is to carry passengers according to contract, while the responsibility of a municipality is to indemnify the carrier for losses allowing him to renew his park of buses (trolleybuses). This would help to renew the national park of public transport.

More private carriers could be engaged in local passengers transportation. Most of them can offer lower costs than bus parks. This would help to implement the market principles in this area stimulating all carriers to improve their services, while bus parks would be forced to reduce the payment for passenger transportation.

All parties could benefit from it because the government would save money for local passenger carriage, while the increasing competition would result in better transport services.

## **8 Planning and organizing local (urban and suburban) transportation**

For the efficient planning and organization of local (urban and suburban) passenger transportation the following regulations should be maintained:

Public transport customer of local (urban) passenger transportation is a transport agent (Transport Board), while in other towns and regions municipalities or their representatives (juridical persons) act as customers. The customer of long-distance passenger carriage is an institution awarding licences and permits for transportation.

The owner (manager) of urban routes on a particular territory is the municipality.



In cities with the population of more than 100 thous. people (in Lithuanian these cities are Vilnius, Kaunas, Klaipėda, Šiauliai and Panevėžys), the municipalities authorize a transport agent (Transport Board) to plan and organize transportation, while in other towns and regions planning and organization of local public transport is performed by municipalities or their authorized agent (Transport Board).

The functions of the municipality authorized transport agent (Transport Board) are as follows:

- 1) to organize the research on the problems of local communication by public transport, especially the study of passenger flows;
- 2) to develop and upgrade the network of local routes for public transport;
- 3) to establish, change and cancel the local routes of passenger carriage by public transport taking into consideration the flows of passengers;
- 4) to determine the volume of work for public road transport on local routes in accordance with service cost and financing of carriers;
- 5) to develop and to change the schedules for public transport taking into consideration the flows of passengers;
- 6) to arrange bidding for providing transport services on local routes;
- 7) to give, suspend and abolish permits to carriers for servicing local traffic routes;
- 8) to make and break contracts with carriers for providing public transport services on particular routes;
- 9) to coordinate the operation of various means of land passenger transport of any form of ownership;
- 10) to administrate the income obtained on all urban traffic routes;
- 11) to choose the format of tickets (to approve them except for prices, to alter and to establish the samples) and to arrange their printing and distribution;
- 12) to control passenger tickets;
- 13) to control the performance of carriers operating vehicles of any form of ownership;
- 14) to pay the carriers for their work on particular routes;
- 15) to inform the inhabitants about the routes and schedules of road public transport;
- 16) to perform other functions specified by customer.

The tariffs for regular passenger transportation on local routes are fixed by the respective municipality commissions.

## **9 Other ways of improving passenger transportation in Lithuanian cities**

In addition to the above measures aimed to improve urban passenger transportation, a number of other means should be used, including:

- 1) optimization of operation of all means of passenger transport (i.e. buses, private buses, fixed-route taxis and trolleybuses in Vilnius and Kaunas) based on the research conducted;





- 2) the analysis of passenger flows on the routes (for route correction and traffic schedule optimization);
- 3) coordination of schedules of all transport facilities taking into account flows of passengers and their daily, weekly and yearly fluctuation;
- 4) selection of adequate capacity transport taking into account the fluctuation of passenger flows;
- 5) paying the carriers only for ordered and provided transport services according to the contract;
- 6) implementation of the 'Parken and Ride' system at the approaches to the central areas of Vilnius and Kaunas providing multi-storey car parking facilities;
- 7) upgrading passenger information system;
- 8) provision of separate traffic lanes for public transport;
- 9) provision of bicycle paths and the development and implementation of bicycle transport system;
- 10) designing a new high-speed transport facility in Vilnius and Kaunas based on the conducted research;
- 11) creation of passenger transport database;
- 12) adaptation of public transport facilities to handicapped people;
- 13) upgrading work schedules of enterprises aimed to reduce passenger flows during peak hours in the morning and in the evening;
- 14) regular retraining of passenger transport personnel to raise the quality standard of the provided services, thereby making public transport more attractive to passengers.

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