

IMPROVING URBAN PUBLIC OPERATION: EXPERIENCE OF ROSTOV-ON-DON (RUSSIA)

V. Zyryanov
Rostov State Civil Engineering University
Rostov-on-Don, Russia

R. Sanamov
Municipal transport company "Rostovpassagirtrans"
Rostov-on-Don, Russia

ABSTRACT

This paper estimates experience of development of urban public transport in city Rostov-on-Don, Russia. The main aims of policy of municipal authorities on reforming public transport are analysed. The integrated decision of a problem included achievement of the following purposes: creation most appropriate structure of management of city public transport, change of form of ownership of public transport operators, improvement of competition on the entry of market of transport services, optimization of a routes network of public transport.

INTRODUCTION

Rostov-on-Don is located in a southern part of Russia and is the main city of a Southern Federal District of Russia. In the city lives about 1.1 million inhabitants and surface area of the city is 324 sq. km. Total length of a road network of city up to 1200 km. In Rostov-on-Don there are three main modes of public transport: buses, trolley buses and trams. Daily volume of transportation of public transport is more than 1 million passengers.

The most difficult years for providing mobility of the population it was the years of transition from fully planned system to the policy of market economy. Over the last 10 years in Russia was changed considerably the role of the state and local authorities in management of public transport. The main reasons for this essential changes was political and economic.

The specific problem for urban public transport systems in Russia was contradiction between reduction of the subsidies to passenger transport and remaining legislation for many of categories of the passengers on a right on free-of-charge or partially paid of trip. The expenditure of the operators for transportation of these passengers were not to the full compensated by state and municipal authorities and it worsened a financial position of the transport companies.

It was typical initial conditions for public transport system for many of cities in Russia. However the methods of solving this problem and results were different. Rostov-on-Don one

of the first cities created program of development of public transport system and as result provided conditions for market approach on the local public transport. The overall transport strategy of authorities of city consists in implementation of the priority tasks of development of a urban transport system on the basis of a set of methods institutional regulation, increases public-private partnership in public transport, traffic engineering providing a given level of a transportation service at rational usage of financial assets.

ANALYSIS OF REFORMING OF URBAN PUBLIC TRANSPORT IN ROSTOV-ON-DON

As well as as a whole on the country, the management system of public transport in Rostov-on-Don for long time was rigidly planned, with full state and municipal ownership of public transport. This system did not provide necessary quality of transport service. In the latest years of activity in city of a fully planned system of public transport (1992-94 years) deficiency of buses on the urban routes reached 40 %. The state and municipal transport companies were unable to satisfy demand of passengers on transportation. Therefore from system of full state regulation it was necessary to proceed to competitive system with participation of the operators of various forms of ownership.

In that period many contradictory processes in policy, economy and social sphere simultaneously developed. The number of individual cars has increased and the share of trips on these cars has increased too. But at the same time the number of the inhabitants requiring for social protection has increased and level of public transport demand remained significant. The share of trips on public transport makes about 70% in the general parameters of motorized trips of the population of city (Fig 1, 2). Economic activity of many enterprises was reduced, but appeared new centers of business activity. Therefore the existed network of routes of public transport became inefficient. In these conditions of implementation of a principle "the mobility for all" has required development of the decisions system for increase of efficiency of functioning of transport system of city of Rostov-on-Don.

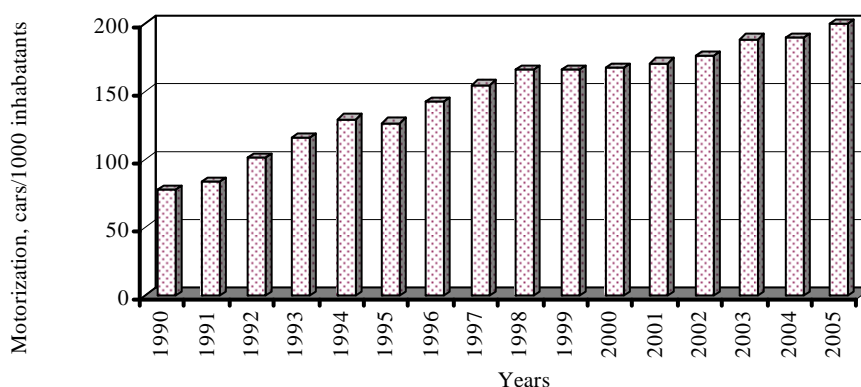


Figure 1: Level of motorization in Rostov-on-Don

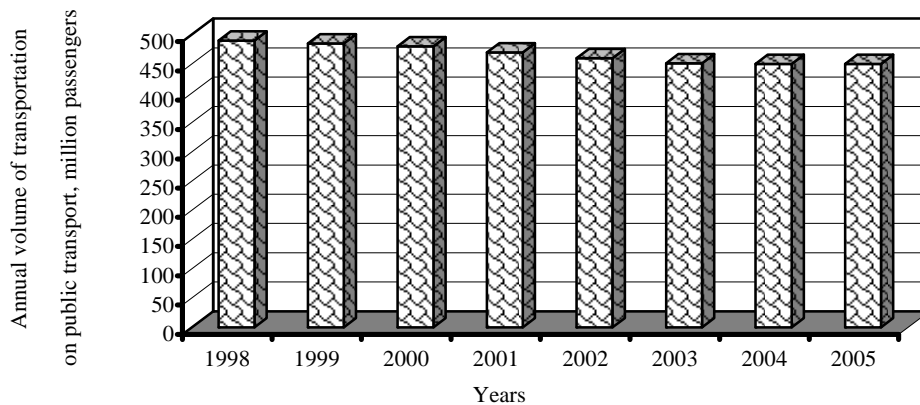


Figure 2: Annual volume of transportation on public transport in Rostov-on-Don

Unlike many cities of Russia in case of Rostov-on-Don the period of transition from planned conditions to market conditions for activity of public transport has passed practically without deterioration of the basic parameters of transportation. It became possible as result of the timely decision of following tasks:

- Research of experience of development of urban public transport systems in the European countries, Andersen (1992), Banister (1992), Hounsell (2000);
- Reforming of system of management by urban public transport in Rostov-on-Don using principles of a competition at entrance to the market of transportation and creating equal conditions for transport operators of all kinds of ownership;
- Use of the program and target planning of development of transport system on the basis of traffic simulation, transport planning, optimization of a routes network of public transport;
- Implementation of new technologies for management of public transport and traffic control system.

The situation was changing as follows. As well as all over the world, at the initial phase of transition to a competitive system the access to the market of transportation was received by many small-sized operators and personal owners of buses (1-2 buses per owner). In 1994 on the routes network of city began transportation first buses of private operators of public transport. Rates of growth such operators were essential enough: 1994 - only 31 buses of private ownership, 1995 - 69 buses of commercial transport agencies and 101 buses of private ownership, 1996 - already 300 buses of the commercial agencies and 85 buses of private ownership. Besides on city routes there was a significant amount of the buses which were not having permissions to carry out transportation of passengers. Positive factors from occurrence of such buses on routes were eliminated due to erratic operation of buses without timetable, unauthorized choice of routes and low level of services.

Then as a result of improved conditions of a tender for the right to service urban routes, number of operators which received access on the market was reduced. The average size of operator was considerably increased, and the small-sized operators were not held one's positions on the market of urban passenger transportation owing to competitive strife. As a result of those processes there was a transition from set of small-sized carriers to large commercial operators, which one can ensure quality of services on public transport.

For reforming structure of management by public transport in 1996 municipal establishment "Municipal government of transport " which began to carry out management of public

transport system. The main tasks of this municipal management completely corresponded to new economic conditions:

- Development and implementation of policy of City Administration of Rostov-on-Don on the public transport to satisfy the requirements of inhabitants of the city in mobility;
- Creation of the equal conditions for development of every of the public transport agencies irrespective of the patterns of ownership which are carrying out transportation on the urban network;
- Definition of conditions of the entry on the market of urban public transportation with observance of requirements of a conscientious competition and the antimonopoly law for of all operators, irrespective of the organizational-legal form and a pattern of ownership;
- Implementation of the open competition for allocation of public transport operators on the routes network in framework of the municipal order on the transportation;
- Transport planning and optimization of routes of the network;
- Regulation of fare policy according to an economic calculation of main public transport operators (at least 5 operators) of all patterns of ownership;
- Control of public transport activity for definition of parameters of quality of service of passengers of urban public transport;
- The integration of public transport management system with using real-time monitoring buses on the lines.

The basic difference of policy of authorities of Rostov at reforming public transport from other cities of Russia was conditions of equality between all of operators. It is such important economic and social themes as fare, transportation of passengers of reduced fare, distribution of subsidy for transportation of such passengers. The competitive decisions in public transport were supported by public private partnership and involving of the private investments for development of the independent operators. As result the number of buses on urban routes has increased with 410 in 1992 up to more than 1000 (Fig. 3). The all this increase of quantity of buses has taken place in the private companies. The change of structure of number of buses on a form of ownership is given in a Fig. 4.

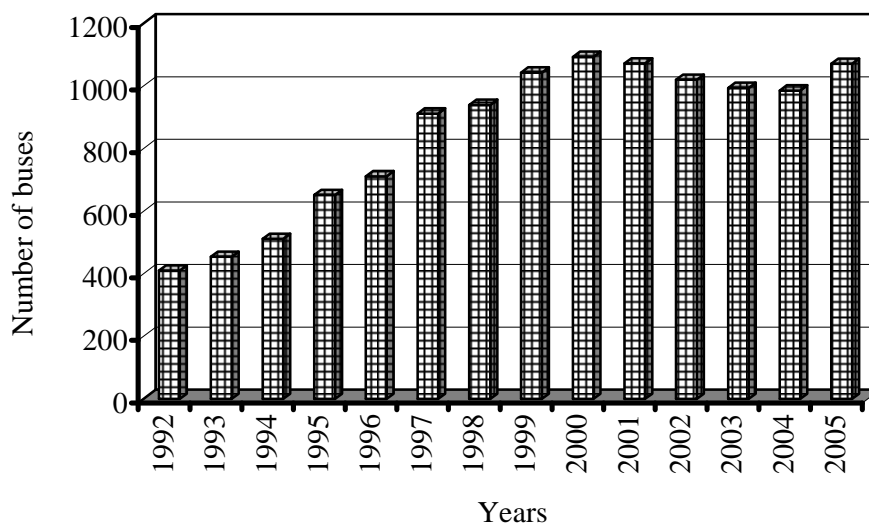


Figure 3: Increasing of number of buses in Rostov

The elements of market strategy can not be realized to the full for such short term. The real social and political situation does not allow refusing municipal transport. In these conditions the decisions on more effective operation of municipal public transport were developed. At the first stage four municipal bus enterprises were incorporated in the municipal transport company. The reforming of structure of municipal transport has resulted in significant improvement of financial parameters of the company. The improvement of management has allowed to reduce number of the personnel at the same volumes of transportations. The optimization of material and financial flows has reduced expenses of the municipal transport company. The cost value of transportation of the passengers in the municipal transport company "Rostovpassagirtrans" is lowest in Russia for cities with the population about 1 million inhabitants. Regularity of operation of public transport is greater than buses of the private companies.

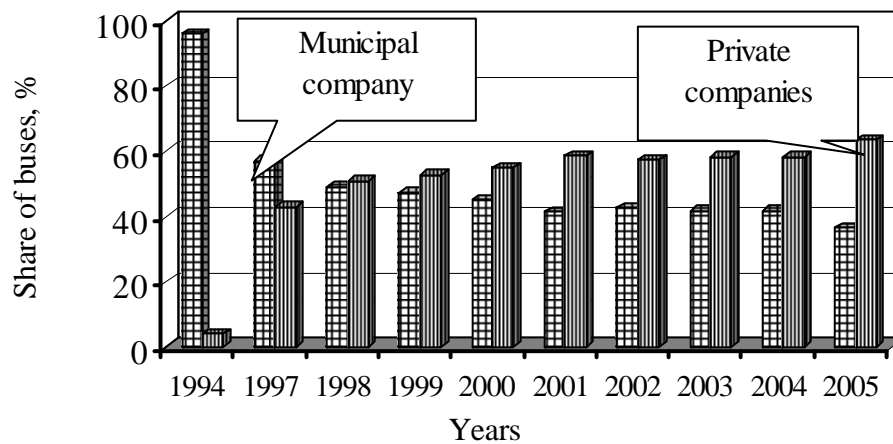


Figure 4: Share of buses in the transport companies of various forms of ownership in the city Rostov-on-Don

The evolution of methods of management of public transport in city of Rostov-on-Don can be presented on the basis of the analysis of the following major factors (table 1).

Table 1: Methods of management of public transport in Rostov-on-Don.

The main changes in public transport policy	1992	2007
Management system	Full planned system of transportation	Intermediate management system of public transport with market-oriented methods. Private operators has the main share of transportation (63%).
Regulation of entry on the market of transportation	Activity only of state and municipal transport companies	Competition and competitive conditions of entry on the market to the operators of any form of ownership. The contract on transportation of passengers at a won the tender.
Fare system and control of fares	The uniform fare on the basis of a priority of social functions of urban public transport.	Regulation of fare policy according to an economic calculation of main public transport operators (at least 5 operators) all of forms of ownership. Fare confirm the city government.
Type of operating subsidies	The subsidies without dependence from results of transportation.	The subsidies for a covering of loss of the incomes from transportation of social categories of the passengers under the reduced fares.

TRANSPORT SYSTEM SIMULATION AND TRANSPORT PLANNING

In connection with fast growth of traffic in streets of city of Rostov-on-Don it is necessary to use modern methods of simulation for solving of transport problems. All plans on increase of efficiency of action of transport system cannot be reached without application of modern methods of simulation of transport systems. It is obvious, that the urban level is the basic place of the application of various methods of simulation. Considerable advantages can be obtained with the usage of microscopic traffic simulation and optimization of network of public transport. But for application of simulation it is necessary previously to study parameters of traffic flow. This important stage of researches has been executed at creation of model of a network of city Rostov-on-Don and microsimulation for an estimation of development of a network, traffic management and public transport. Therefore were solved following tasks:

- To make monitoring parameters of traffic flow on an urban network;
- To determine level of service and to estimate congested conditions;
- To realize simulation of assignment of traffic flow in urban network and estimation of original-destination matrixes;
- To make optimization of network of public transport;
- To determine architecture of the Urban Traffic Management System, stages of development of the UTMC and a condition of interacting between UTMC and System of Management of Public Transport;
- To make the forecast of the system effectiveness and to calculate the cost - benefits analysis.

This investigation based on the monitoring the real traffic information on the urban network of Rostov-on-Don, simulation using advanced soft AIMSUN NG (TSS, 2005), TRANSYT and models for optimization of network of public transport. Simulations and experiments data give the essential information for reliable estimates of the quality of traffic service and determine a development strategy of an urban transport system.

The analysis of parameters of a traffic flow on main streets of city Rostov-on-Don shows, that in a time interval from 8 a.m. till 7 p.m. the probability of existence level of service A in averages only 5 %. In basic main streets of city operate in difficult traffic conditions at level of service D and E, it makes about 62 % from duration of a considered time interval. The most complicated situations corresponding to traffic congestions exist during 13 % of duration of this phase.

For each of the basic segments of a network the fundamental diagram of a traffic flow has been calculated. Experience of investigation of traffic flow and simulation at development of a system in Rostov-on-Don has shown, that the most exact results give a set of models J.M. Del Castillo and F.G. Benitez, two-fluid models R. Herman and I. Prigogin from the kinetic theory of traffic flow and models of the theory of catastrophes. Models J.M. Del Castillo and F.G. Benitez were applied because they can be accommodated for a change of the functional form of relation flow - density. Realistic relations flow - density have been obtained on the most various types of roads and for different conditions. On the basis of these data has been calculated capacity of bottlenecks and created the forecast of increase of capacity at development of a network. Comparative results for one of sites are shown in figures 5, 6.

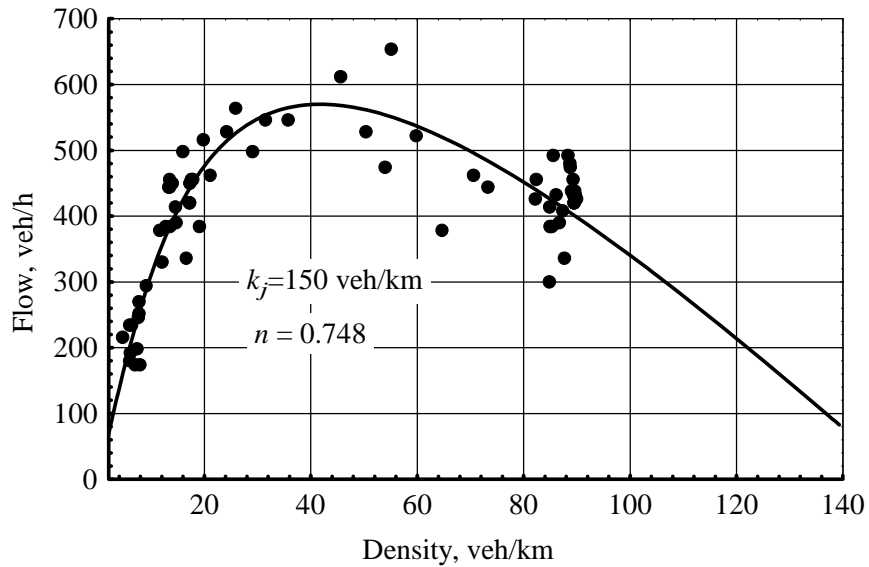


Figure 5: The fundamental diagram for an existing situation. Experience data.

On the basis of TRANSYT and microsimulation with using AIMSUN NG was calculated program of co-ordinated operation of traffic signals in the central business district of Rostov-on-Don. The co-ordinated of traffic lights increased capacity and reduced delays on 11-12%. Figure 7 shows efficiency of new parameters of traffic lights during a rush hour. After implementation new traffic control strategies of decrease in speed occurs much less.

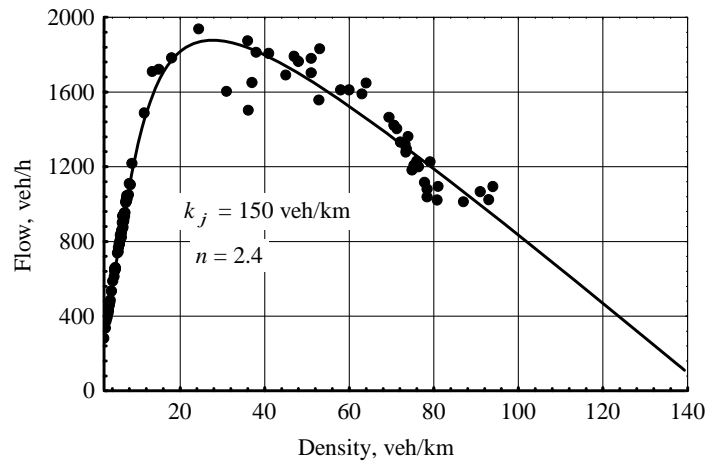


Figure 6: The fundamental diagram for scenario of development of network and traffic management. Simulation data.

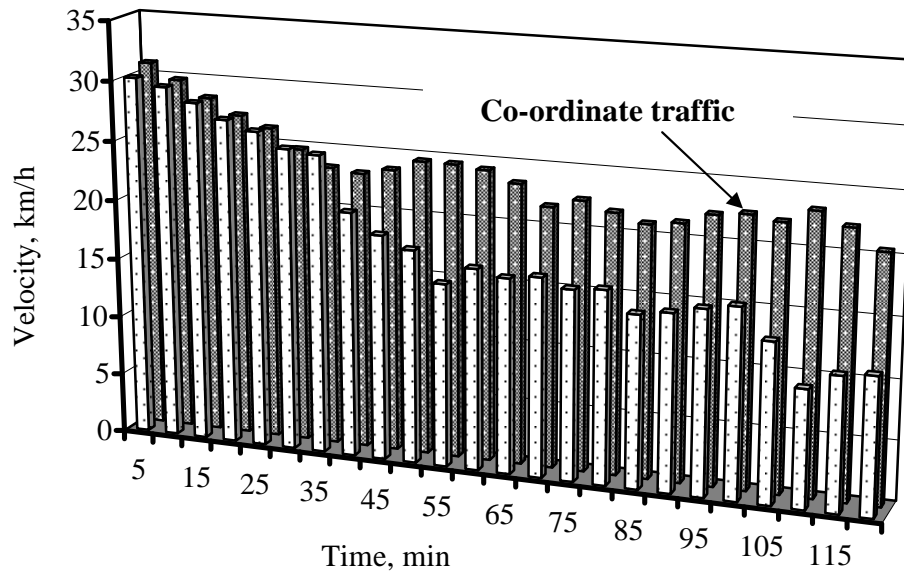


Figure 7: Comparison velocity for rush hour

The mathematical models of transport planning were used at the analysis of points of origin, destination, volumes of trips between various zones of city, estimation of demand on transportation. The model is based also on such data as density of the population in various zones, allocation of objects of business activity, universities and shopping centers. The city was divided into 282 zones. During modeling the matrixes O-D and diagrams of distribution of volumes of transportations of the passengers on a network are constructed. On the basis of transport planning the perspective urban routing network is designed. It has allowed to open new bus routes, to reduce average trip time of the passenger and number of transfer to buses of other routes.

THE PROGRAM-TARGETING APPROACH AND FUTURE TRENDS

Since 1998 management by transport system of city is carried out only on the basis of program of target planning. Now the city Government has Program of development of public transport and transport infrastructure within 2010. Main directions of this Program are:

- Use of new technologies of management by public transport (Public Transport Payment System, Automatic Bus Location, Public Transport Priority, Information for passengers);
- Development of city electric transport. Increase in a share of transportation of passengers by trolleybuses and by trams with 8 up to 21 %;
- Development of a routes network of public transport;
- Creating System of Public Transport Security.

REFERENCES

- Andersen B. (1992). Factors affecting European privatization and deregulation policies in local public transport: the evidence from Scandinavia. *Transpn. Res. – A*, **26A**, 2, pp. 179-191.
- Banister D., Berechman J., Rus G. (1992). Competitive regimes within the European bus industry: theory and practice. *Transpn. Res. – A*, **26A**, 2, pp. 167-178.
- Del Castilio J.M., Benitez F.G. (1995). On the functional form of the speed-density relationship – I: General theory. *Transpn. Res. – B*, **29B**, 5, pp. 373-389.
- Del Castilio J.M., Benitez F.G. (1995). On the functional form of the speed-density relationship – II: Empirical investigation. *Transpn. Res. – B*, **29B**, 5, pp. 391-406.
- Herman R., Ardekani S.A. (1984). Characterizing traffic conditions in urban areas. *Transp. Sci.*, **18**, 3, 1984, pp. 101-139.
- Hounsell N.B. (2000). Improving urban bus operations: Recent experience in the United Kingdom. *Proceedings of the International Conference CODATU IX*, pp. 263 – 268.
- TSS –Transport Simulation Systems, 2005, AIMSUN NG, User's Manual, <http://www.aimsun.com>