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RESEARCH OF INFLUENCE OF SMALL CAPACITY PASSENGER VEHICLES TO WORK OF TRANSPORT SYSTEM

Summary. The task of increase of traffic safety has got a special acuteness for large cities of Russia in connection with expansion of service of passengers of route taxis. In the paper results of research of technical operation's conditions of route taxis, qualifications and the experience of their drivers are resulted, and also some ways of increase of safety on city routing traffic are offered.

ИССЛЕДОВАНИЕ ВЛИЯНИЯ ПАССАЖИРСКИХ ТРАНСПОРТНЫХ СРЕДСТВ МАЛОЙ ВМЕСТИМОСТИ НА РАБОТУ ТРАНСПОРТНОЙ СИСТЕМЫ

Аннотация. Задачи повышения безопасности дорожного движения приобрели особую остроту для крупных городов России в связи с увеличением обслуживания пассажиров маршрутными такси. В данной работе проведён анализ условий технической эксплуатации маршрутных такси и стажа водителей и их квалификации, а также предложены некоторые пути увеличения безопасности на городских маршрутах.

1. INTRODUCTION

The development of market economy in Russia has increased the need of large megapolises population to go at the same time and the same place while there is simultaneous reduction of the number of people having the same targets.

In such situation it has been found out that there is incapacity of the majority of motor transport enterprises to provide the movement of all passengers because of insufficient intercity route net and using rolling stock of high seating capacity.

That's why it has become typical for many Russian cities to use route taxis of 15 seating capacity while there is a constant increase in the number of routes and vehicles as well.

However the problem of filling of vehicles on transport net is not only the Russian problem, but also of other countries, e.g. Chinese one [1, 2].

Many authors consider this problem in different ways [3-7]. Moreover, the problems of ecological safety of vehicles obtain more and more importance [8, 9].

In our paper we suggest to revise the problem of the number of passenger urban transport from the point of view of the road safety, road transport accident, conveyance speed and ecological component of transport means exploitation (harmful emissions).

2. OVERALL ASSESSMENT OF ROUTE TAXI PUBLIC CONVEYANCE IN THE CITY

Route taxi conveyance provides efficient combination of conveniences of taxi and economy of bus service. At the same time servicing of a small group of people makes a trip more comfortable (there are only seats in the minibus), allows partially take into account individual demands of passengers (optional stop), accelerate the speed of road service and considerably cut the cost of a trip (compared to taxi) [10]. To solve the above problem the good results can be achieved with using a regional transport simulations [11].

When there is a constant route line and terminal points, there is no need to fix stops; they should be done at the request of passengers. It reduces the time, which passengers need to come to the bus station and which passengers spend on the trip. The frequency of route taxi public conveyance is rather high and that reduces the time passengers need to wait for a vehicle at the bus station. A big amount of different routes lines, covering even the most remoted points and directions, let a passenger choose the most convenient route, what reduces the time of a trip and dispose of the difficulty to make a change.

Main roads running across the areas with multiple cultural and public places, trading centers and administrative settings are of utmost interest to commercial public conveyance providers. The passenger traffic in such areas remains constant throughout the day. The growth in the number of conveyance providers and in the volume of conveyance results in the traffic density growth, which in view of the tough frames of the street network leads to the increase in traffic jams and fuel consumption, accelerated wearing of vehicles' details and their units. Urban population, participating in the traffic, is subjected to road traffic accident (RTA), vehicle emission, microscopic particles of tyre and brake wear.

With certain hourly traffic at some parts of city main roads, traffic stream *changes the quality of environment*, raises the risk RTA and becomes rather dangerous for environment.

3. THE ANALYSIS OF ROUTE TAXIS TRAFFIC FACTORS

For many years the "Faculty of automobile transport" with the help of students from the "Traffic organization and safety" has been studying the characteristics of traffic flows, traffic schedules, the service life of components of automatic switching center systems, guaranteeing the exploitation safety.

Special attention is paid to city routes, running through the areas with higher frequency of transport and pedestrian flows crossings. Control (random) survey has showed that the area of the higher passenger traffic and, as an effect, of higher transport traffic is Lenin avenue, 2,5 km long in Volgograd downtown. There are three bus routes, five trolleybus routes, 46 route taxi routes, including 32 transit ones. There are also private vehicles, which also carry passengers. The main three-lane road separate by green plantations up to 30 m width.

According to early published researches [12] the hourly traffic of passenger car in the transport flow of one direction at this part of the main road in daytime didn't exceed 790 vehicles/h, minibuses 320 vehicles/h, trolleybuses 56 vehicles/h, buses 5 vehicles/h. The traffic of surface transport was maximal till 2 p.m. and then was slowly decreasing by 1,5 times by 6 p.m. and by 4 times by 9 p.m.

Though in 2009, 2010 hourly traffic in daytime stayed practically the same, the hourly traffic of passenger car raised to 900 vehicles/h, route taxis to 440-480 vehicles/h, the hourly traffic of public transport didn't change. In 2011, 2012 the rise of hourly traffic was going on: the intensity of passenger car run up to 1380 vehicles/h and to 740 vehicles/h of route taxis. The hourly traffic was

coming to the main road capacity, while the hourly traffic of trolleybus was noticed to fall down to 50-52 vehicles/h.

In daytime this part of the road is characterized by columned traffic, maneuver is complicated with the high traffic density (90-110 vehicles/km), big number of crossroads and pedestrian crossings (the number of private vehicle stops is 5-7, of route taxis is 9-13; an average time of waiting is 20-30 seconds; the block speed of motor transport doesn't exceed 16-20 kmh and of trolleybus 10-14 kmh.

To research block speed of route taxi conveyance it was held the analysis of the influence of such factors as the tardation per one kilometer, the hourly traffic (fig. 1 and 2).

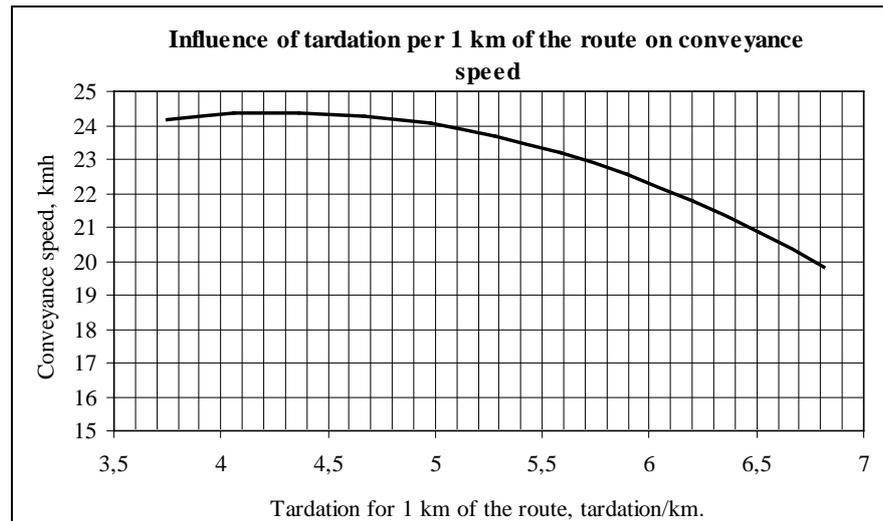


Fig. 1. Influence of tardation per 1 km of the route on conveyance speed

Рис. 1. Влияние числа замедлений на 1 км. маршрута на скорость сообщения

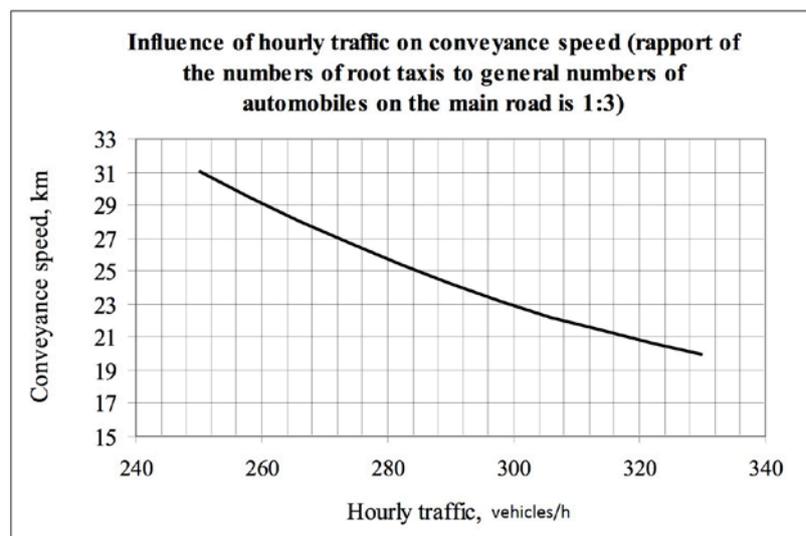


Fig. 2. Influence of hourly traffic on conveyance speed (rapport of the numbers of root taxis to general numbers of automobiles on the main road is 1:3)

Рис. 2. Изменение скорости сообщения при соотношении интенсивности движения маршрутных такси к общей интенсивности автотранспортных средств на магистрали 1:3

The block speed is mostly influenced by the tardation per one kilometer. On the average there are about 4,2 tardation per kilometer. The increase of tardation by 10% reduces the block speed

approximately by 6%. The hourly traffic (310 vehicles/h and even more) greatly influences the block speed. The hourly traffic increase by 5% results in the reduction of block speed by 2%.

At the same time, according to the researches, the way of moving of route taxis and of other vehicles in the traffic flow considerably differ (tab. 1). The more mobile private cars and route taxis, occupying the three lanes, “reduce” the trolleybus lane capacity.

Table 1
The way of moving of route taxis and of other vehicles in the traffic flow

Vehicles	Running-away, %	Slowing down, %	Even movement, %	Flitting run, %
Route taxis	31,1	26,2	17,5	25,2
Private transport	22,8	15,9	31,3	30,0
Trolleybuses, buses	18,5	12,8	29,2	39,5

When there is an increase in the route taxi hourly traffic, the transportation capacity of the public transport is being used not completely, while there is an increase in car and road accident risk. At the same time it must be taken into account that the constant economic development of passenger servicing with route taxis makes such drivers be in demand. Mass involvement of untrained personnel lowers the level of traffic safety.

4. THE ANALYSIS OF QUALIFICATION AND DRIVING EXPERIENCE OF THE DRIVERS OF ROUTE TAXIS

Research drivers' driving experience of one Volgograd large commercial automobile operating company specializing on public conveyance by route taxis have shown that driving experience more than 70% of drivers are 5 – 10 years (fig. 3). At the same time up to 50% of route taxis drivers have driving experience less than three years. They are insufficiently known specificity of technical operation of small capacity passenger vehicles. It is regular overweight of the vehicles, inefficient using of braking system with ABS, etc.

Low qualification of the route taxis drivers as well as their low level of legal consciousness and inadequate understanding of the reasons for RTA are main reason for driving offence.

According with information of the Volgograd Road Police since 2005 annual increase of RTA to drivers of public transport is 25% [13]. RTA of public transport had proceeded in 2012 and as well as last years about 65% have occurred to drivers of route taxis.

The dynamics of RTA and hourly traffic is resulted on fig. 4.

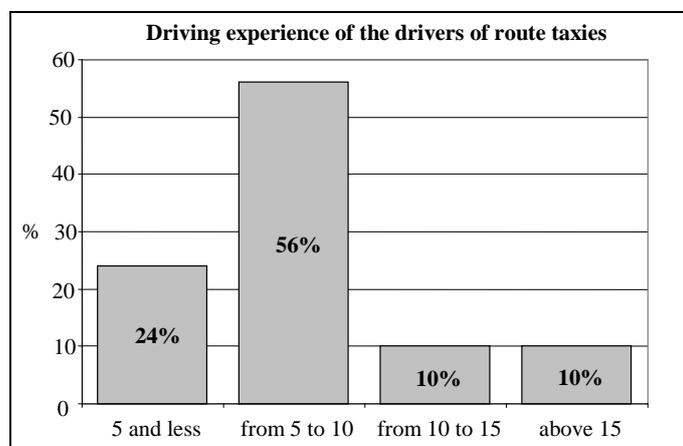


Fig. 3. Driving experience of the drivers of route taxis

Рис. 3. Динамика общего стажа водителей маршрутных такси

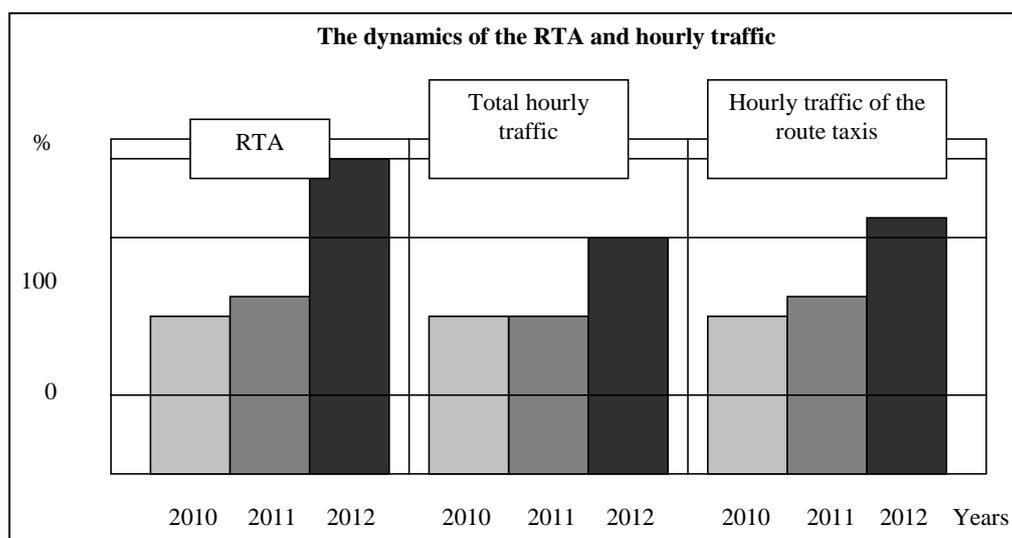


Fig. 4. The dynamics of the RTA and hourly traffic

Рис. 4. Динамика ДТП и интенсивности движения по годам

5. THE ANALYSIS INFLUENCES OF VEHICLES ON ENVIRONMENT

The variable mode of motion as well as "stop-and-go" driving and cluster of vehicles are reason of elevated pollution road side by incomplete-combustion product. The results of performed research [14-16] on environmentally neglected three-lane roads at 420-600 one-lane hourly traffic (30-40% route taxis) have shown that exhaust emission specification will be 72,7-90,8 kg/km h (CO); 5,2-6,6 kg/km h (C_nH_m); 10,4-13,0 kg/km h (NO_x). But exhaust emission route taxis are 50% [16]. Control measurements (summer, day time) have shown that CO median concentration at road side (storey factor is 7-12; urban concentration is 70-80%; green plantings; wind speed is 2-5 m/s at edge of main road at height from 0,5 up to 4) are 8,7-2,6 mg/m³.

Researches on the large passenger terminal of Volgograd "River port" have allowed exhaust emission from different kind of transport (fig. 5).

However influence of vehicles on environment visualizes exhaust emission per passenger (fig. 6).

6. RESULTS

Intensive using of route taxis on maximum passenger traffic flow are main reason for reducing efficiency of a transport system as well as increasing possibility of MVA and process of braking ecology.

Municipal formations are promoting transportation service of new quality. They should control the technological process of these services for decrease harmful factors menacing to road safety and health. Organization of traffic in the streets parallel to a main road, as well as imposing severe limits on the traffic density in the environmentally insecure sections of a city main road, controlling the number of vehicles on a commercial route and improving the training system for the route taxi drivers may help us to develop a traffic system that would in the most possible way combine high vehicle efficiency with the minimal influence on the environment.

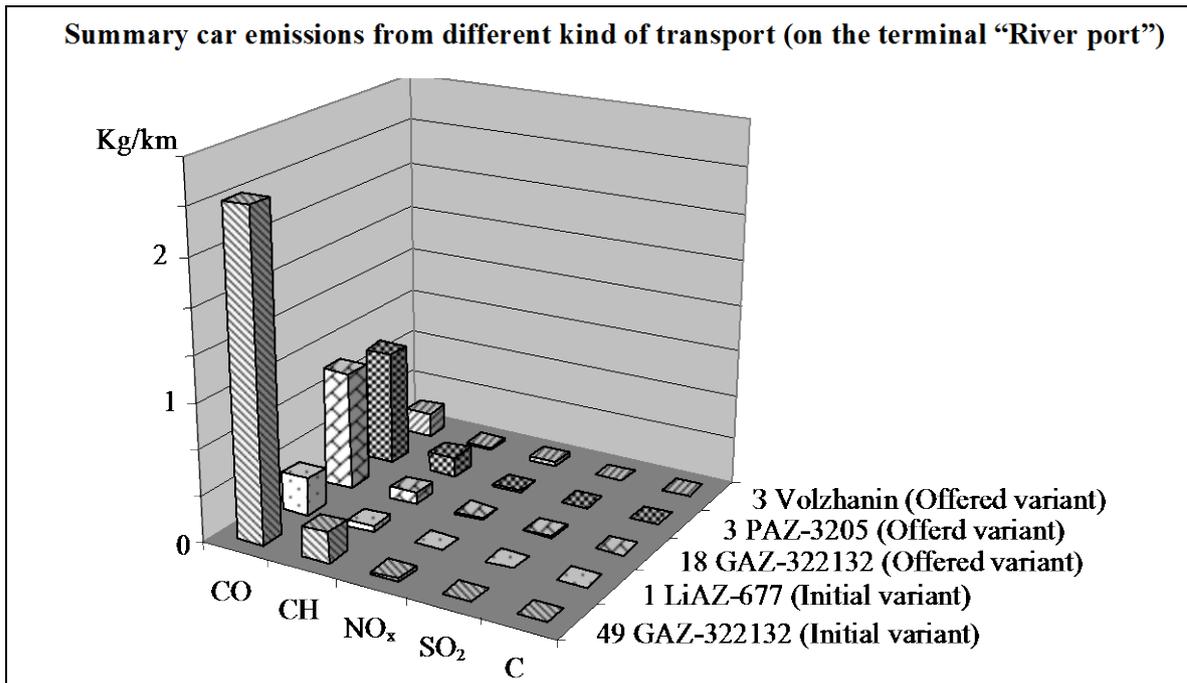


Fig. 5. Summary car emissions from different kind of transport (on the terminal "River port")

Рис. 5. Суммарные выбросы вредных веществ от пассажирского транспорта, обслуживающего терминал «Речной порт»

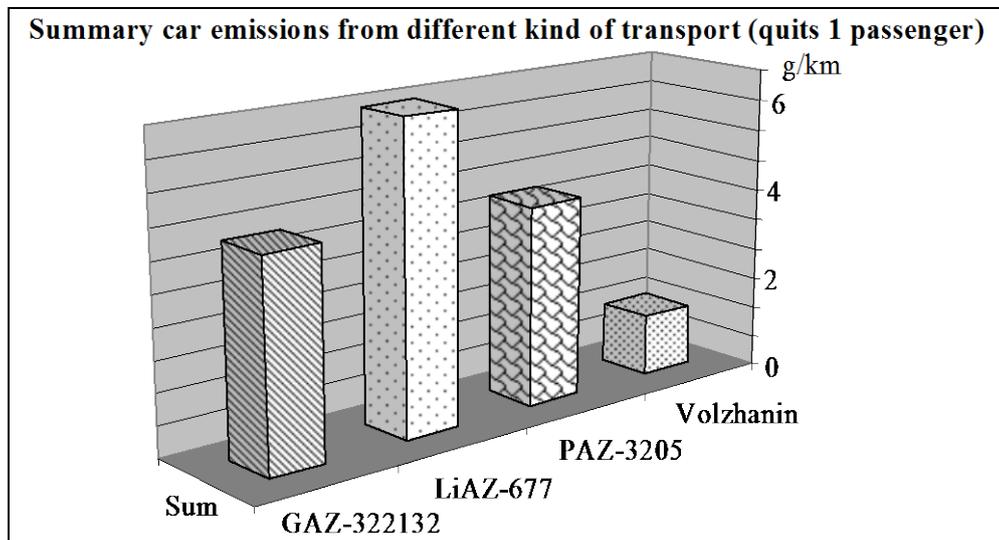


Fig. 6. Summary car emissions from different kind of transport (quits 1 passenger)

Рис. 6. Суммарные выбросы вредных веществ на 1 сидячее место пассажира различных типов подвижного состава

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