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STUDY OF FACTORS AFFECTING PUBLIC TRANSPORT TRAFFIC TIME
ИССЛЕДОВАНИЕ ФАКТОРОВ, ВЛИЯЮЩИХ НА ВРЕМЯ ДВИЖЕНИЯ ОБЩЕСТВЕННОГО ТРАНСПОРТА

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Abstract. One of the quality indicators of commuter passenger transport services is punctuality that is directly related to the well-planned route vehicles schedule. The results obtained in the article allow us to conclude that irrational norms of traffic time of vehicles have been established on certain routes, without taking into account factors affecting them (traffic speeds, passenger flows, drivers, etc.) and require adjustments. The norms of traffic time of vehicles along stretches of commuter public transport routes should be differentiated depending on route number and the period of day. To reduce the influence of drivers on the amount of deviations from the norm of arrival time at transport stops provided by the schedule.
Keywords: commuter public transport, norms of traffic time of route vehicles.

Introduction

On commuter public transport routes, buses must operate according to specially schedule, regardless of changes in traffic conditions. In real conditions, this schedule is disrupted by various factors [1, 2]. Many of these factors make it difficult to assess their impact on time and speed of buses along the route. However, taking into account the most significant factors when drawing up schedule can facilitate the solution of the issue. Let's consider the situation with the organization of commuter passenger transportation in the city of Gomel (Belarus) on the example of following stretches: "Gomel Bus Station – Rechitsky Microdistrict" (forward direction), "Solnechnaya – Gomel Bus Station" (reverse direction).

The norms of traffic time serve as initial information when distributing buses along routes, drawing up their schedules [3, 4]. The norms of time are set taking into account the duration of movement on stretches, passenger exchange at transport stops and breaks at the end transport stops of route.

To study factors affecting public transport traffic time, a block of initial data was formed. The initial data consists of route number, the actual time of movement of route vehicles on stretches, deviations from the norm of arrival time at control transport stop, the period of day, driver's service number.

Statement of basic materials

To assess the statistical relationship between route number and traffic time of route vehicle in the program "Statistica" [5, 6], the Kruskal-Wallis test was used, which is designed to evaluate the differences in the averages of several samples according to the level of any indicator, and the Fisher test, which is used to evaluate the differences in the variances of several samples.

In Figure 1, the calculation results showed that according to the Kruskal-Wallis test and Fisher test, p<0.05. This indicates the significance of influence of route number on traffic time of buses on stretches in forward direction. In reverse direction, the results showed that route number does not affect traffic time of bus on stretches, because p>0.05.
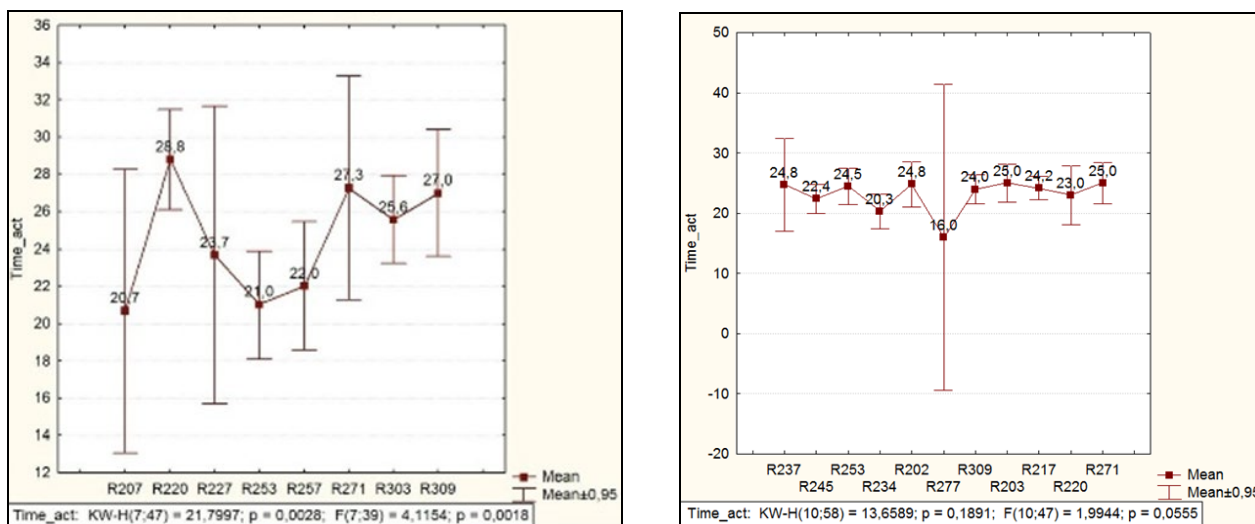

Figure 1 – The significance of influence of route number on traffic time of buses on stretches a) forward direction, b) reverse direction

Differences in the significance of influence of route number can be explained by the fact that stretch of route is considered in forward direction when moving from starting transport stop. On this stretch, there is a delay of vehicles at transport stops due to the boarding of passengers. Passengers are boarding only through the front door of bus, as passengers pay for travel. Therefore, the amount of passenger traffic has a significant impact on downtime of transport at transport stop.

Stretch "Solnechnaya – Gomel Bus Station" is the final one in opposite direction. Passengers exit vehicles at transport stops through all the doors. The capacity of passenger traffic has less effect on transport delays at stops. The revealed dependence indicates the need to determine the norms of traffic time of vehicles by stretches, depending on route number.

The results showed that according to the Kruskal-Wallis test and Fisher test, the period of day does not affect traffic time of bus on stretches in forward direction, because p>0.05 (Figure 2). In opposite direction, there is statistically significant dependence of traffic time of bus and the period of day (p<0.05).

The study showed that when buses move in forward direction, factors related to route number (for example, passenger traffic capacity) have significant impact on travel time. When moving in opposite direction, factors that do not depend on route number have a significant impact.

In Figure 3, according to the Kruskal-Wallis test and Fisher test (p<0.05), there is statistically significant dependence of deviations from the norm of arrival time at transport stops and route numbers. The significance of impact of this factor is explained by the influence of characteristics of vehicles (dynamic parameters, service life), as well as the experience and psychophysiological condition of drivers.
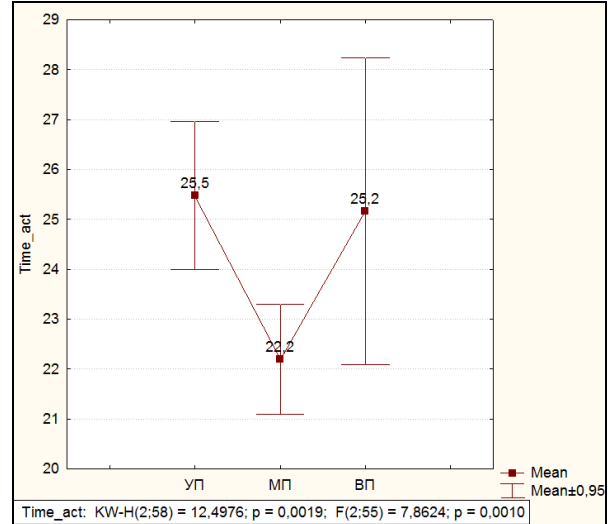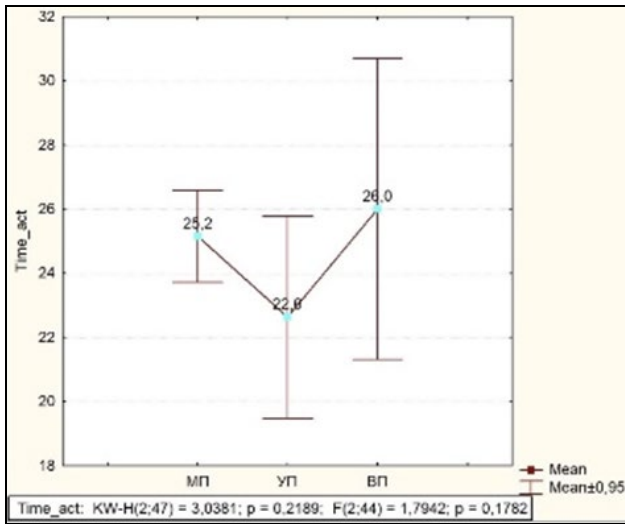
Figure 2 – The significance of influence of the period of day on the time of bus movement on stretches a) forward direction, b) reverse direction
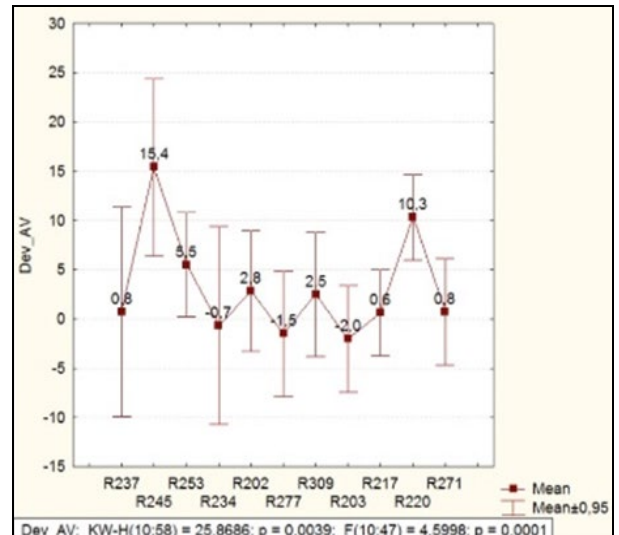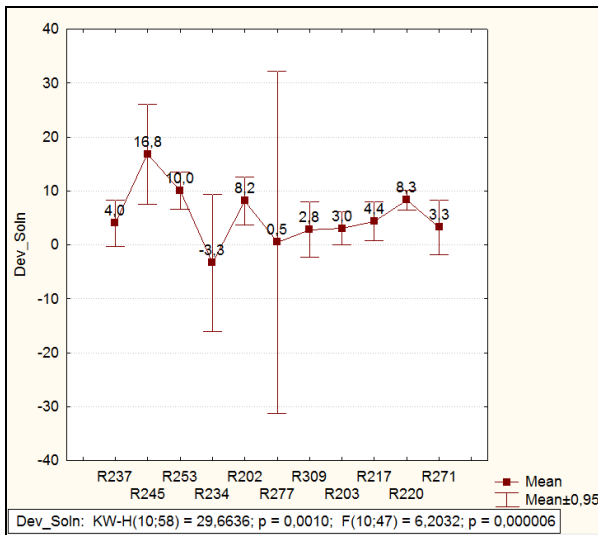

Figure 3 – Assessment of effect of route number on deviations from the norm of arrival time at transport stops: a) "Solnechnaya", b) "Gomel Bus Station"

Figure 4 shows assessment of influence of the period of day on deviations from the norm of arrival time at transport stops: " Solnechnaya", "Gomel Bus Station". Similar results were obtained in the study of influence of route number and the period of day on deviations from the norm of arrival time at transport stops of stretch: "Gomel Bus Station" – "Rechitsky Microdistrict".

The study showed that the period of day does not affect deviations from the norm of arrival time at transport stops.

However, there is a dependence of deviations and driver's service number. This dependence is explained by the human factor. The driving time of vehicles is influenced by the experience, the psycho-emotional state of driver, the duration of the shift, noise, other road users, traffic accidents, and more. At the end of working hours, the physical condition of driver may be affected by fatigue and drowsiness (Figure 5).
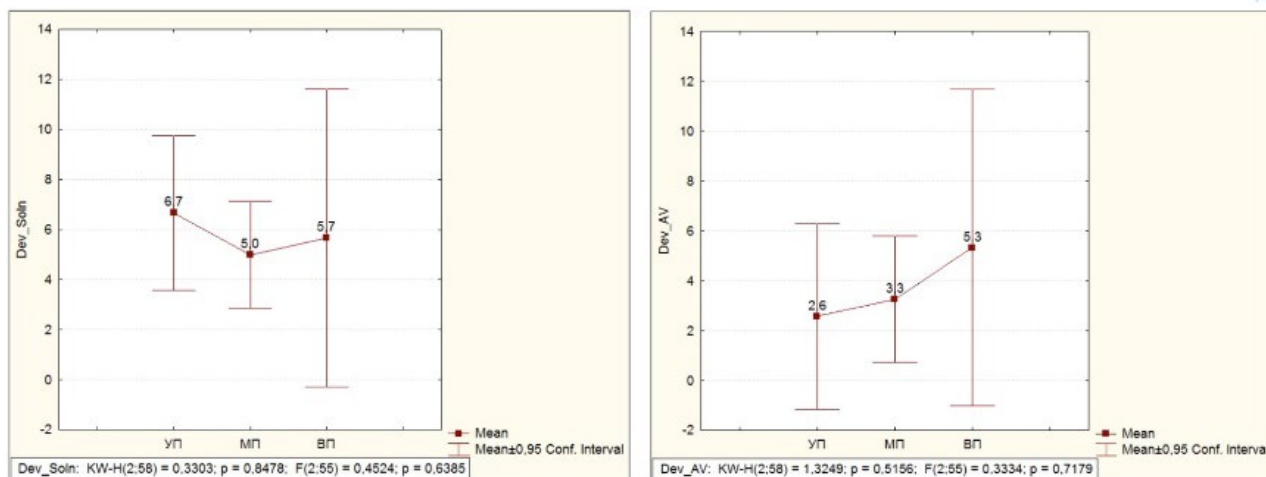
Figure 4 – Assessment of influence of the period of day on deviations from the norm of arrival time at control transport stops:
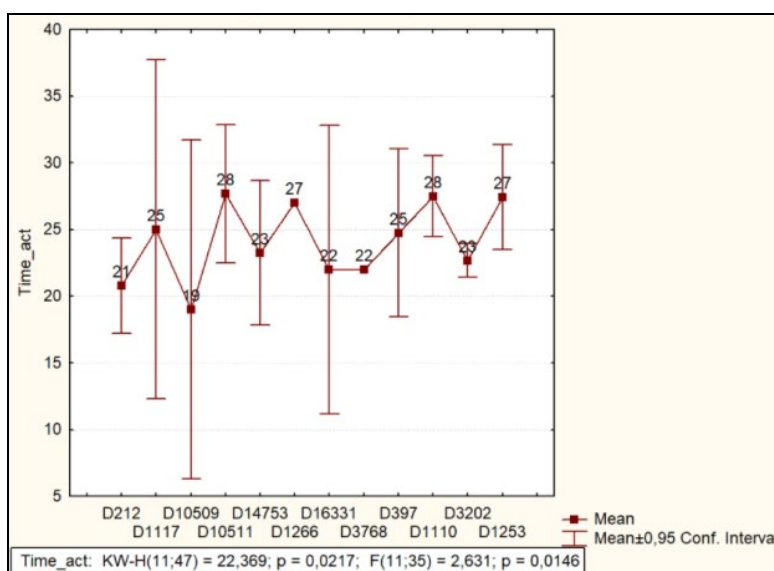**a) "Solnechnaya", b) "Gomel Bus Station"**

Figure 5 – Assessment of influence of driver's service number
on deviations from the norm of arrival time

Conclusions

The results obtained allow us to conclude that irrational norms of traffic time of vehicles have been established on certain routes, without taking into account factors affecting them (traffic speeds, passenger flows, drivers, etc.) and require adjustments. The norms of traffic time of vehicles along stretches of commuter public transport routes should be differentiated depending on route number and the period of day. To reduce the influence of drivers on the amount of deviations from the norm of arrival time at transport stops provided by the schedule. It is possible to equip route vehicles with navigation communication terminals, which will allow drivers to control the time of following the route.

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Аннотация. *Одним из показателей качества обслуживания населения общественным транспортом является регулярность движения, которая напрямую зависит от грамотно составленного расписания маршрутных транспортных средств. Полученные в статье результаты позволяют сделать вывод о том, что по отдельным пригородным маршрутам установлены нерациональные нормы на движение транспортных средств, без учета факторов, влияющих на них (скорости движения, пассажиропотоков, водителей и т.п.) и требуют корректировки. Нормы времени следования транспортных средств по участкам пригородных маршрутов необходимо дифференцировать в зависимости от номера маршрута и времени выполнения рейса. Снизить влияние водителей на величину отклонений от времени прибытия на остановочный пункт, предусмотренного расписанием. Возможно оборудование маршрутных транспортных средств навигационными связными терминалами, которые позволят водителям контролировать время следования по маршруту.*

Ключевые слова: *пригородный общественный транспорт, нормы времени движения маршрутных транспортных средств.*

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