DOI: 10.63550/ICEIP.2025.87.59.027

Dedicated Public Transport Lines as a Factor in Reducing Noise Exposure

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Keywords: environmental well-being, noise impact, equivalent noise level, atmospheric pollution, impact factors, road network, public transport, dedicated lanes, traffic load, sustainable development.

Abstract: Public transport is the focal point of urban space, which simultaneously provides the social, economic and environmental components of human well-being. With the development of the urban transport system, the degree of motorization in urban environment begins to decrease gradually, and the chemical and physical parameters of the impact on a human body represented by air pollution from exhaust gases and high levels of noise exposure are minimized. The complex of dedicated lanes will create an advantage for public transport when choosing a method of transportation among representatives of the urban population. Dedicated lanes will contribute to the reorientation of human thinking and thereby help reduce the need for daily use of a passenger car and the level of motorization in general. For the carrier, the dedicated lanes will attract additional passenger traffic, and, accordingly, revenue. By reducing the time to travel between control points, it will be possible to increase the regularity of traffic without adding additional units of rolling stock to the route.

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DOI: 10.63550/ICEIP.2025.87.59.027

1 INTRODUCTION

The popularization of urban public transport contributes to the development of a complex of passenger transportation, which in turn establishes stable connections of passenger correspondences between institutions of medicine, education, trade, and public utilities. Urban transport enlivens urban space, increases social interaction, increases pedestrian activity and, most importantly, improves road safety.

As the area of cities grows, the number of zones that need to be provided with transport service functions also increases. However, to create all connections between all zones of the city is, firstly, technically impossible, and secondly, impractical. As cities developed in the part of passenger transportation, the term "change" began to be actively used, when a passenger moving from point "A" to point "B", needs to use two or more options for urban public transport routes.

2 MATERIALS AND METHODS

Urban transport has an influence in achieving sustainable development of territories and reducing the influence of environmental parameters of chemical and physical nature. If the public transport system represented by modern rolling stock will have a centralized dispatch system and priority in rapid movement from one control point to another, then the city dweller will begin to think about what transport he will use to get to work, school, a recreation or leisure area by public transport or car.

An important decision in the development of the institution of urban transport is the implementation of separated traffic lanes for unimpeded movement of public transport at the sites of the city road network.

Figure 1: A possible option for organizing a dedicated lane for public transport on Anapa highway, Novorossiysk.

By reducing the time required to overcome certain stages (sections between checkpoints), the time required to complete 1 return route is also reduced, and accordingly, the number of trips performed by public transport increases. The regularity of traffic is increasing, and the level of passenger confidence in public transport is becoming higher. By increasing the number of trips through the implementation of separated traffic lanes, the passenger flow increases, and with it, the revenue of carrier enterprises providing passenger transportation on routes increases.

As noted earlier, the essence of separate lanes for urban transport is to allow public transport to travel through certain areas faster during peak hours, peak hours, and also to reduce the total number of traffic accidents on the road network due to a decrease in the number of passenger vehicles. Separated traffic lanes, as a rule, are organized on the right extreme lanes of traffic flows and are designated by the letter "A". Experience has shown that separated traffic lanes make it possible to increase the speed of urban public transport by up to 30%, and in the first year of implementation of a complex of separated traffic lanes, passenger flow increases by 30%, and the number of accidents is reduced to 29%.

In addition to reducing the share of motorization through the development of public transport and the organization of lanes “A” on the right side of the streets, public transport moving along separated traffic lanes also help reduce the level of noise exposure in cities. Noise affects both behavior and the health of a human body as a whole. This factor has a negative impact on the cardiovascular, central nervous systems, and, directly, on a human hearing organ.

3 RESULTS

Figure 1 shows the trolleybus timetable on route No. 14 in the city Novorossiysk. The upper part of the figure shows the original (current timetable), the lower part shows the predicted traffic timetable along the trip with an additional return route, which will be possible to carry out after the appearance of separated traffic lanes for public transport in the city.

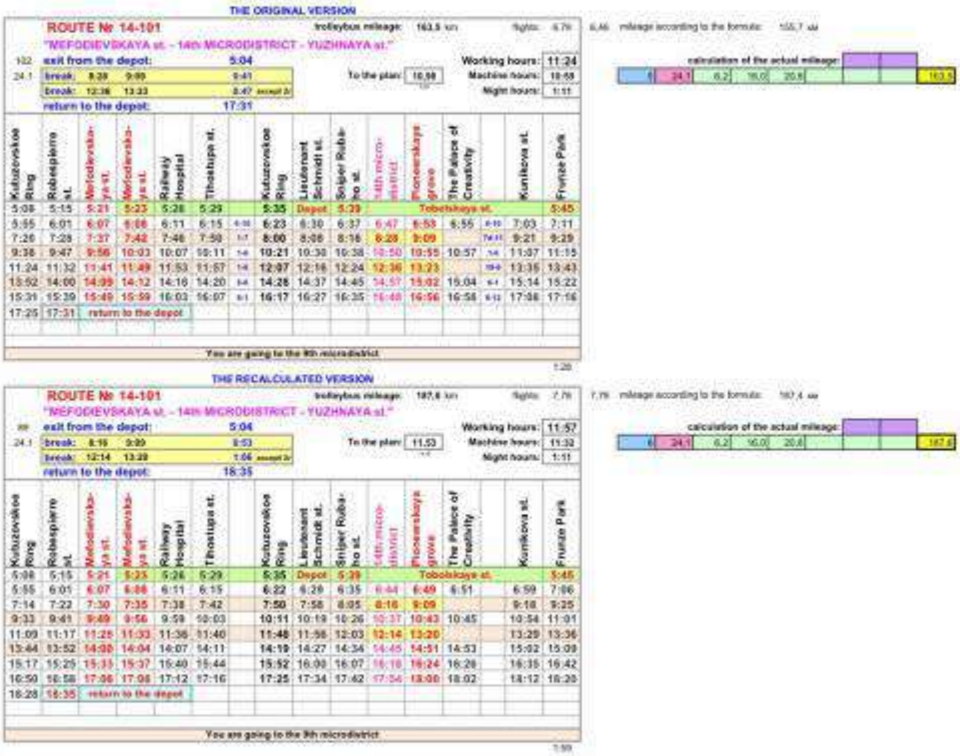

Figure 2: Timetable for trolleybuses on route No. 14 in the city Novorossiysk in the original and recalculated versions.

Depending on the category of the road, the width of the traffic lanes for vehicles varies from 3.0 to 3.75 m for sections with two or more traffic lanes and 4.5 m or more for sections with one traffic lane. The equivalent noise level (in dBA) at the calculation point is determined by the following formula:

$$L_{эквR} = L_{экв} - 10Klg * R / r_0, \qquad (1)$$

where $L_{экв}$ – equivalent sound level at a distance of 7.5 m from the center of the nearest traffic lane, dBA;

r_0 – equal to 7,5 m;

K – coefficient taken under noise decrease at the expense of ground surface type (for ground with grass K = 1,1, for snowy surface K = 0,9);

R – distance to the target site.

The work of calculating noise impact indicators from transport units is multifactorial and includes many adjustments (number of vehicles in the flow/hour, percentage of public rolling stock and freight transport units, average operating flow speed, longitudinal slope of the highway, ratio of street width to the sum of building heights).

The coefficients given in the calculation methodology show that the noise level in the urban environment is reduced by increasing the distance of the noise source (the main traffic flow) to the calculated point and the share of public transport, reducing the maximum speed on road network facilities, and organizing rows of green spaces along the roadway.

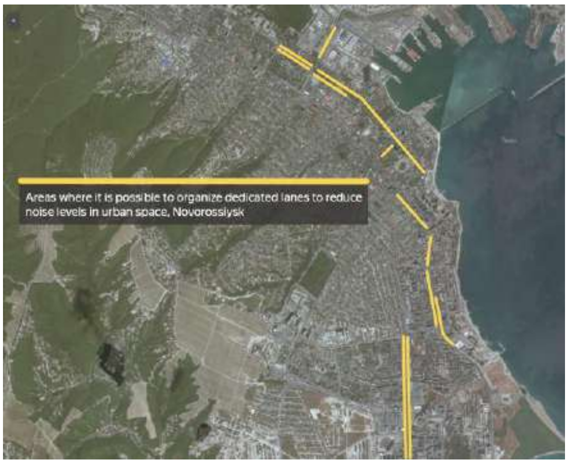

Figure 3: Areas where it is possible to organize dedicated lines to reduce noise levels in urban space, Novorossiysk.

4 DISCUSSION

Separated traffic lanes are not only a solution to the issue of developing public transport in terms of speed. Lanes “A”, separated from the main flow, make it possible to carry out more measures to ensure road safety (reducing the number of accidents by reducing the share of personal cars on city streets, working to eliminate chaotic parking areas for vehicles that slow down the pace of the main flow of traffic and blocking the viewing angles of drivers of other vehicles performing the corresponding maneuvers).

In parallel with the development of public transport, urban areas are developing. Separated traffic lanes make it possible to avoid the practice when, due to the congestion of the road network, decisions are made to increase traffic lanes or organize parking spaces by eliminating green areas, which in urban space act as “barriers” that reduce the level of noise exposure.

5 CONCLUSION

Separated traffic lanes are a necessary component for the stable and efficient functioning of the institution of urban public transport. The step-by-step process of introducing separated traffic lanes during the gradual “interception” of sections of the city’s road network will improve the quality of services provided by public transport, make its work more efficient, and, finally, reorient the interests and thinking of the urban population and reduce, by diminishing the number of cars, the load on both the natural environment and the human body.

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