

PAPER • OPEN ACCESS

Actions to Increase Road Safety in the Ploshchad Vtoroy Pyatiletki Square in Rostov-On-Don

To cite this article: D N Sorokina and V P Kolganov 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **666** 062036

View the [article online](#) for updates and enhancements.

You may also like

- [The architectural environment authenticity preservation in the updating and renovating urban space context \(on the example of the Rostov-on-Don city\)](#)
A.V. Sagalaev
- [Experimental studies of the reinforcement percentage effect on the modulus of soil deformation fixed by cementation](#)
A Yu Prokopov, I V Sychev, A A Revyakin et al.
- [Assessment of the water facilities' impact types on the basin geosystems' geosphere during construction and operation](#)
E D Khetsuriani, V L Bondarenko, A I Ilyasov et al.



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Actions to Increase Road Safety in the Ploshchad Vtoroy Pyatiletki Square in Rostov-On-Don

D N Sorokina¹, V P Kolganov²

¹DSTU, Rostov-on-Don, Gagarin square 1, 344001, Russia

E-mail: naukauni@mail.ru

Abstract Nowadays, the problems of the road-and-street network are among the key priorities in big cities. This article studies the problems of streets and roads in Rostov-on-Don. It dwells upon one of the most complicated areas in the city, the southern side of the Ploshchad Vtoroy Pyatiletki square, including the adjoint Nemirovich-Danchenko st., and Sheboldayev st. The authors analyzed the current traffic pattern and identified its drawbacks. This junction is regularly congested, and accidents often happen in the area. The analysis of the southern side of the Ploshchad Vtoroy Pyatiletki square in Rostov-on-Don helped identify the traffic rate, driving conditions, and driving comfort. Based on these results, some actions were suggested to improve road safety in this area.

1. Introduction

One of the key challenges for large cities is facilitating traffic safety in their street and road network. Car ownership level increases every year and the transport infrastructure cannot keep up with the growing requirements of the city. Facilitating safe and fast transportation requires a number of architectural, planning, and organizational actions, as well as the reconstruction of the existing streets, building traffic junctions, pedestrian crossings, etc. Large-scale architectural and planning actions require significant capital investments and a long stretch of time. On the other hand, organizational actions deal with the traffic patterns in the existing street and road network and help solve problems quickly and efficiently [1-3].

2. Relevance

The problems of the road and street network in Rostov-on-Don are among the most pressing [4-7]. This article considers the reorganization of traffic patterns on the southern side of the Ploshchad Vtoroy Pyatiletki square, including the adjoint Nemirovich-Danchenko st., and Sheboldayev st. (Figure 1) [8].

This area requires efficient actions to improve the quality of the road network and reduce the number of road accidents.

Nemirovich-Danchenko st. begins from Larin st. and ends at the Ploshchad Vtoroy Pyatiletki square. The length of the street is 1.22 thousand meters. This street is an important transport corridor in the city because it is the only road that runs to the Kamenka microdistrict and the shortest route from the city center to Taganrogskaya st. leading to Voenvod and Stroygorodok microdistricts, as well as to Vavilova st. leading to Suворovskiy and Severnyi residential areas. The aforesaid conditions the high rate of traffic. Nemirovich-Danchenko is a one-way street that is part of the route for six buses



and six shared taxis. The carriageway is three driving lanes wide. Along the entire Nemirovich-Danchenko st., there are 5 one-level junctions, 1 of which has traffic light control. There are also 2 exits to residential areas. Besides, since the street runs through a detached house area, there are over 70 exits to private driveways along the street.

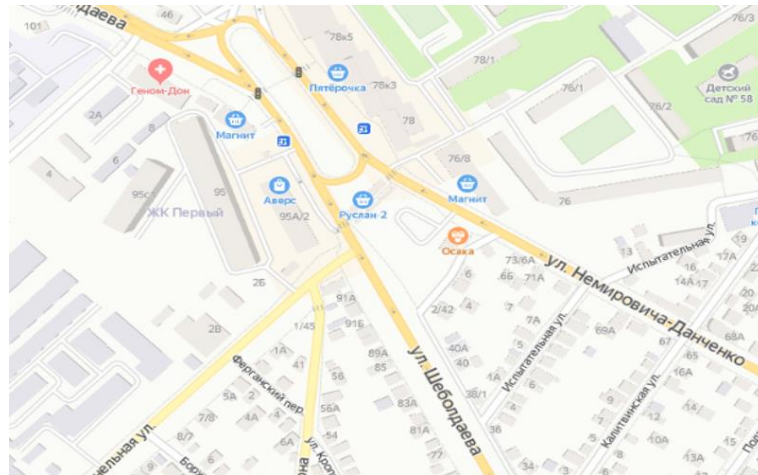


Figure 1. Ploshchad Vtoroy Pyatiletki square in Rostov-on-Don.

Being a city thoroughfare, Sheboldayev st. begins as an extension of Stadionnaya st. from the Nansen st. intersection and then runs north up to the bridge across the Temernik river near the Ploshchad Vtoroy Pyatiletki square. This street is about 1.7 kilometers long and its carriageway is about 18 meters wide. Sheboldayev st. is one of the thoroughfares connecting the center of the city with the Severnyi residential area and Voenved and Bolgarstroy microdistricts. The function of this road explains the high traffic flow and density. For the most part, the carriageway consists of six lanes (three lanes for each direction). The section to the south of the Ploshchad Vtoroy Pyatiletki square up to the Ploshchad Narodnogo Opolcheniya square is a one-way street. Sheboldayev st. has about 19 intersections and over 50 exits to residential areas, shopping malls, hospitals, and other urban infrastructure facilities.

The Ploshchad Vtoroy Pyatiletki square in its southern part is the intersection of Nemirovich-Danchenko and Sheboldayev streets. There are three exits to residential areas and the Avers shopping mall parking lot. The intersection is a roundabout. There are no traffic lights at the intersection except a traffic light at the pedestrian crossing in the middle of the square.

In 2019, 31 accidents occurred in this area, in which 14 people were injured and none died. These accidents include 21 car crashes, 8 obstacle collisions, 2 pedestrian run-over.

3. Statement of problem

We analyzed the location and condition of road signs, marking, and technical regulation devices and found a major violation of the Marking rules [9]. The surface of the road is in poor condition: there are cracks, potholes, and wheel gauge. According to GOST R 50597-93 Automobile Roads and Streets. The Requirements to the Level of Maintenance. Satisfied the Traffic Safety, this intersection requires a major road mending with the replacement of the surface layer [10].

One of the key negative factors in the arrangement of traffic patterns in the intersection is the presence of a zebra crosswalks in Nemirovich-Danchenko and Sheboldayev streets, which leads to the increased accident rate. The pedestrian traffic in this area is high because there is a shopping arcade nearby. Pedestrians and drivers face limited visibility. The presence of two lanes in the roundabout section from Sheboldayev st. to Nemirovich-Danchenko st. also significantly increases the accident rate. The installation of traffic lights will help significantly improve road safety in this area.

4. Theory

Road traffic optimization is based on the data obtained through the study of the road-and-street network, such as car traffic intensity, driving conditions at intersections, and driving comfort [11, 12].

The traffic intensity at the intersection was measured in the autumn, on workdays, and during the rush hours (9.00 - 9.30 a.m., 6:00 - 6:30 p.m.). The intensity obtained was extrapolated to one hour. We also calculated the normalized intensity for each direction. The highest traffic rate in Nemirovich-Danchenko st. for cars heading straight ahead is 3883 cars per hour and for cars turning right, 213 cars per hour during the evening rush hour. For the cars going along Sheboldayev st. and heading straight ahead, the traffic rate amounted to 4347 cars per hour during the morning rush hour, and for the cars turning left, 411 cars per hour during the evening rush hour. For those entering the intersection from the residential area and turning right, the traffic rate was 176 vehicles per hour during the morning rush.

To evaluate the complexity of the intersection, we identified the conflict areas and their danger. The intersection complexity value was determined through a 5-point scale of conflict area danger [13]. We plotted a conflict area chart that showed that there are 2 intersection points, 3 diversion points and 3 junction points in the intersection analyzed (Figure 2). According to the complexity value obtained, this intersection is a simple one.

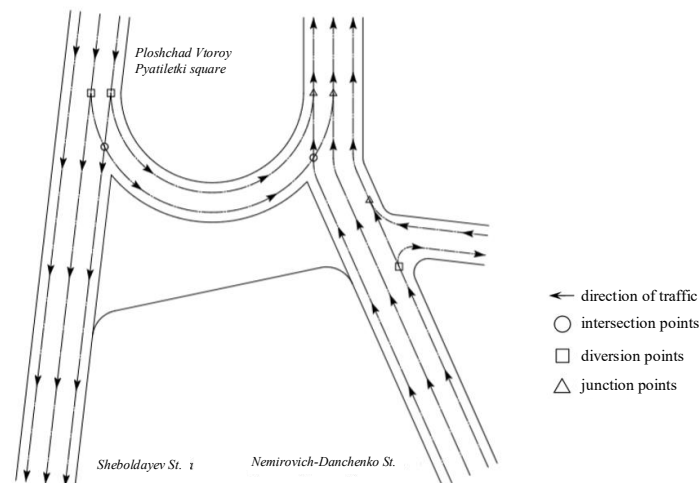


Figure 2. Conflict areas in the Ploshchad Vtoroy Pyatiletki square in Rostov-on-Don.

It was found out that the situation in the intersection is complicated by the presence of a zebra crosswalk. Thus, we investigated the possibility of installing a traffic light there. We suggest that standard traffic lights T.1 and pedestrian traffic lights P.1 should be installed there [9].

To calculate the traffic light phases, we firstly determined the phase coefficient of Y_i for each of the directions [14]. As a result, we obtained the following values: for Nemirovich-Danchenko st., $Y_i = 0.74$, and Sheboldayev st., $Y_i = 0.75$.

At the next stage, we determined the lengths of the controlling and operating cycles of the traffic lights [15]. First of all, we determined the length of the intermediary cycle t_{ic} . in tune with the goal of the intermediary cycle, its length must be sufficient for the cars that entered the intersection during the green phase at a free movement speed could either stop at the stop line or leave the intersection if the green signal switches to yellow. The intermediary cycle corresponds with the yellow signal for the moving cars [16]. The length of the intermediary cycle for the traffic lights in both Nemirovich-Danchenko st. and in Sheboldayev st. is 3 seconds.

Further on, we determined the length of the controlling cycle for the random arrival of vehicles T_{cc} [17]. It is 24 seconds for both Nemirovich-Danchenko st. and Sheboldayev st.

At the final stage, we determined the length of the pedestrian cycle t_{pd} and the length of the main cycle t_{mc} [18]. The length of the pedestrian cycle is 13 seconds, and the main cycle length is 21 seconds for each of the streets.

5. Practical significance, proposals and implementation results, experiment results

We suggest performing the following actions to arrange traffic lights control at the intersection in question:

- 1) Installing a T.1 traffic light in Nemirovich-Danchenko st.;
- 2) Installing a T.1 traffic light in Sheboldayev st.;
- 3) Installing a redundant traffic light along with the main T.1.g one in Nemirovich-Danchenko st.;
- 4) Installing pedestrian P.1 pedestrian traffic lights for the crosswalk in Nemirovich-Danchenko st.;
- 5) Installing pedestrian P.1 pedestrian traffic lights for the crosswalk in Sheboldayev st.;
- 6) Installing an STZH-V section with the countdown function with all of the traffic lights [9].

The analyzed section of the road-and-street network requires new marking and road signs. According to GOST R 51256-99 Traffic control devices. Road Markings. Types and basic parameters. General technical requirements, marking 1.1, 1.5, 1.6, 1.12, 1.14.1, 1.16.2, 1.16.3, 2.7 [19]. According to GOST R 52290-2004 Traffic control devices. Traffic signs. General technical requirements, road signs 2.1, 2.2, 2.4, 4.1.2, 4.3, 5.5, 5.6, 5.19.1, 5.19.2, 5.21, 5.22 (Figure. 3) [20].

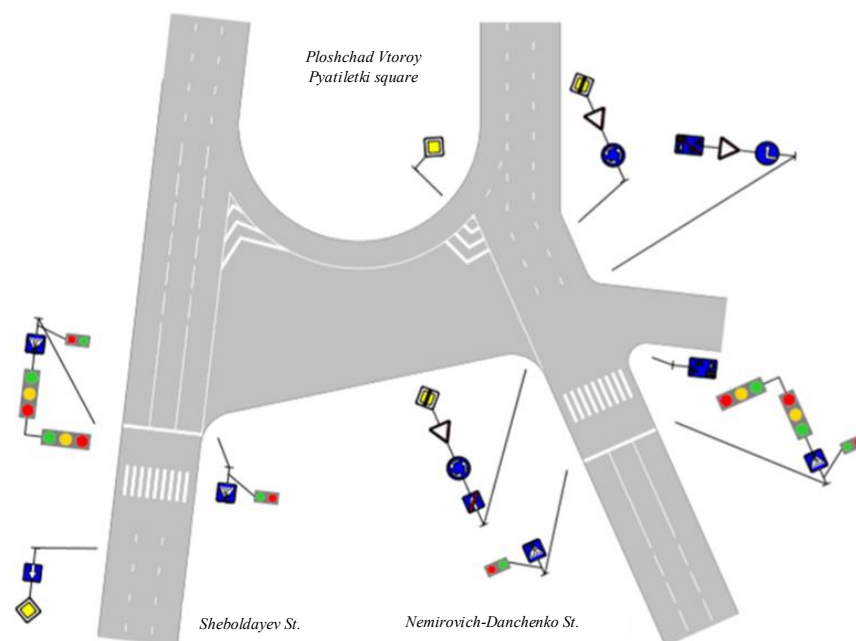


Figure 3. Suggested traffic patterns for the Ploshchad Vtoroy Pyatiletki square in Rostov-on-Don.

6. Conclusion

Based on the results of the analysis of the current situation in the Ploshchad Vtoroy Pyatiletki in Rostov-on-Don, we suggest performing the following actions:

- 1) Arranging traffic lights control for the intersection and the crosswalk;
- 2) Road surface mending;
- 3) Applying vertical and horizontal marking;
- 4) Installing road signs.

7. References

- [1] Terent'ev V V et al 2018 Measures to improve the organization of road traffic *Transport business of Russia* **3** pp 133-136
- [2] Pugachev I N 2009 Organization and traffic safety (M.: Izd. center "Academy")
- [3] Zyryanov V V, Kocherga V G, Pozdnyakov M N 2011 Modern approaches to the development of complex schemes for organizing road traffic *Transport of the Russian Federation. A journal about science, practice, economics* 1(32)
- [4] Sorokina D N, Kolganov V P 2019 Organization of traffic on the example of the road network of the city of Rostov-on-Don *Modern automotive materials and technologies* (SAMIT-2019) pp 336-340
- [5] Kolganov V P, Marchenko Yu V, Sorokina D N 2019 Improvement of road traffic on the example of the street-road network of the city of Rostov-on-Don *Bulletin of transport information* **12** pp 12-14
- [6] Sorokina D N, Kulikova A N Optimization of the road network of the city of Rostov-on-Don (on the example of the intersection of Moskovskaya street - Stachki avenue) *TECHNICAL SCIENCE* p 51
- [7] Sorokina D N, Kolganov V P 2019 Problem of traffic jams in Rostov-on-Don *Modern automotive materials and technologies* (SAMIT-2019) pp 333-335
- [8] Yandex Maps URL: <https://yandex.ru/maps/> (date of access 07/15/2020)
- [9] GOST R 52289-2004 Rules for the use of road signs, markings, traffic lights, road barriers and guiding devices Technical means of organizing road traffic National standard of the Russian Federation (OKS 03.220. 20. - 2004. pp. 2001212-01.)
- [10] GOST R. 50597-93 Highways and streets Requirements for the operational state permissible under the conditions of ensuring road safety (1994)
- [11] Konoplyanko V et al 2007 *Organization and safety of road traffic*
- [12] Andreev K P, Terentyev V V, Kulik S N 2016 Measures to improve the street-road network (New science: Problems and prospects) **115-2** p 156
- [13] Vruble Yu A et al. (2011) *Coordinated traffic management*
- [14] Kremenets Yu A, Pechersky M P, Afanasyev M B 2005 *Technical means of organizing road traffic*
- [15] Zhivoglyadov V G 2009 Methodology for improving the efficiency of road traffic management: dis. (SPb: Author's abstract. dis. ... doc. tech. Sciences)
- [16] Gorodokin V A, Almetova Z V, Leonova O V 2015 Calculation of the intermediate cycle of a traffic light object *Bulletin of the Siberian State Automobile and Road Academy* **6(46)**
- [17] Mikheeva T I, Antoshina E E 2018 Determination of the structure of the traffic light cycle IT & Transport: collection of articles scientific articles ed. TI Mikheeva (Samara: Inteltrans) T 9 104 p P 89
- [18] Alferova I D et al. 2019 Calculation of the duration of the pedestrian phase of the main cycle of the traffic light object *Transport. Transport facilities. Ecology* **1** pp 5-11
- [19] GOST R 51256-99 Technical means of traffic management Road markings Types and basic parameters General technical requirements
- [20] GOST R 52290-2004 Road signs General technical conditions