Road safety strategies in the Russian Federation for 2018–2024 in Omsk Region

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Abstract. The paper explores the causes of accidents and ways to reduce their number through the use of targeted programs to improve traffic safety. The authors justify the choice of target indicators used in the development of such programs. The article gives an example of the development of a set of measures for one of the sections of Omsk city.

1. Introduction
The safety indicators of the transport process, primarily road traffic, do not comply with the world standards. The number of deaths in traffic accidents per 1,000 vehicles is 4 times higher than in developed countries [1]. Modern federal programs targeted to reduce road accidents, as a rule, are focused on a long period of implementation. Each program establishes annual target indicators, the fulfillment of which should ultimately ensure the achievement of the final target national indicator [1, 2].

2. The main part
Road traffic is a multifactorial structure, so it is necessary that the complex of control measures covers all the constituent elements of the problem in a specific territorial unit (region, city, district). Therefore, one of the effective mechanisms for reducing road hazard is the use of an integrated complex approach in ensuring road safety. One of the examples of an integrated approach is the development of targeted programs. This method of reducing road accidents is enshrined at the legislative level and is presented as a priority principle for ensuring road safety. The entire list of activities provided in the framework of integrated programs is aimed at achieving a single goal - improving the road safety [2]. A feature of target programs is a clear target orientation, characterized by quantitative targets. In accordance with the criteria for grouping targeted programs by time of goal achievement, they identify short-term, medium-term, and long-term target programs. The problem of reducing road accidents requires a lot of attention, therefore, to achieve positive results, we should apply long-term targeted programs in the first instance.

At the implementation stage, the target integrated program has the form of a targeted system that evolves over time due to the introduction of the executors required to carry out the relevant activities.
After reaching the goal, the program, as a system, can either end its existence or move to the class of functioning systems that support the achieved goal. A distinctive feature of this method of improving road safety is the development of quantitative target indicators. Thus, the positive effect is achieved due to the structured presentation of the program goal in the form of a system of interrelated subgoals (Figure 1).

![Figure 1. Scheme of the formation of the federal final target indicator of road accidents reduction where \( r_M, R_p, R_f \) - respectively, the results of negative and positive nature at the local, regional and federal levels; \( x, y, z \) - factors that have either a positive impact on the accident rate or a negative.](image)

The issues of developing targeted programs for specific territorial units are described in [3,4]. Indicators of the road safety conditions in Omsk for 2016-2018 are given in Table 1.

| Accident indicator      | 2016 | 2017 | 2018 |
|-------------------------|------|------|------|
| Number of accidents, count | 2318 | 2257 | 2300 |
| Deaths, humans          | 54   | 71   | 77   |
| Wounded, humans         | 2925 | 2789 | 2870 |

For the improvement road safety in different regions of the Russian Federation, they analyze the causes and conditions associated with accidents, and then propose comprehensive measures to reduce accident rates. Examples of such proposals are covered in the proceedings of scientific conferences, where specialists from different federal subjects exchange their experience and analyze the use of modern smart systems, both in Russia and abroad. Such examples of proposals could be seen in [5, 6, 7, 8, 9]. The work [10-12] presents a model of a Smart City. The model is based on traffic police data on the vehicle fleet, the number of accidents, and the number of dead and injured. The key indicators are calculated on the basis of this model.

To reduce the number of accidents we propose the following steps:
1. To perform an analysis of accidents for several years across the entire road network of the study area.
2. To select and rank traffic accidents according to stability and type.
3. To select a group of the most stable places for the concentration of traffic accidents.
4. To study the designated areas in order to identify hazards: limited visibility, dangerous speeds, poor state of technical means of traffic control.
5. To develop a set of measures aimed at eliminating the identified hazards and to achieving the specified goals

To show an example of the measures development, we consider one of the sections of Omsk, which is shown in Figure 2. The proposed accident reduction technology has been developed on its basis.

![Figure 2. Scheme of the intersection of Ordzhonikidze and 7th North street in Omsk.](image)

Let’s look at the data on the dynamics of accidents at this site (Table 2).

**Table 2.** Dynamics of accidents in the areas of Herzen and Ordzhonikidze streets, Omsk.

| №  | Accident concentration place                        | Dangerous areas          | Accident rate dynamics 2014-2017 |
|----|-----------------------------------------------------|--------------------------|---------------------------------|
| 1  | Herzen str – Oktyabrskaya str                       | Oktyabrskaya str., № 48, №65 | 9-20-18-28                     |
| 2  | Herzen str – 7th North str                          |                          | 18-22-26-30                    |
| 3  | Herzen str – 24th North str                         | 24th North str, № 216    | 12-12-14/3-28/5                  |
| 4  | Ordzhonikidze str – Oktyabrskaya str                | № 47, № 56               | 0-18-18-29                     |
| 5  | Ordzhonikidze str – 7th North str                   |                          | 13-23-22-16                    |

We suggest the following activities:
- To move a tram stop from the intersection down to the block for at least 30 meters on the sides 1 and 3;
- To arrange the order of priority movement for drivers by installation of road signs: 2.1 “Main road” on the side 4; 2.4. “Yield” on the side 1; 5.15.1 - “Directions of movement along the lanes” on all the sides;
- To increase the duration of “green” cycles in the traffic light cycle;
- To eliminate defects of the road surface in the conflict zone of the intersection;
- To move the pedestrian crossing down to the block along with the public transport stop;
- To install pedestrian barriers to prevent pedestrians from entering the road.
In order to select an indicator suitable for assessing the actual impact on the traffic conditions of a specific road network during the implementation of municipal programs, and associated with the generally accepted target index \( N_n \), we carried out a study of quantitative relations of generally accepted indicators of road accidents among themselves:

- \( N_n \) – number of deaths,
- \( N_{id} \) – number of accidents with deaths or injuries;
- \( NMVC \) – number of accidents with only material damage.

We used the following sample for statistical analysis: about 500 thousand traffic accidents (469700) for a long period (15 years) on the road network of the city of Omsk. Based on the analysis, we made the following conclusions.

1. Between the average annual indicators: there is a relation between the number of accidents with dead \( N_n \) and the number of accidents with injured \( N_{id} \) within certain limits. The same conclusion was made in relation to the number of accidents with injured \( N_{id} \) and the number of accidents with only material damage \( NMVC \).

2. The entire street-road network of a big city can be decomposed into several groups of streets and roads with a stable range of the annual accident rate. This conclusion can be used when planning the sequence of activities for the systematic reduction of accidents across the city. For example, it was revealed that for the city of Omsk, traffic incidents occur on 850 streets out of a roughly 1,300 streets in total. We selected the most dangerous streets from the general list of emergency streets, which is about 12% of the total number of streets with the accidents. In 15 years, there were about 350 thousand traffic accidents on these streets, which is 77% of the total number of traffic accidents in the city. The most emergency streets are also divided into the groups according to the quantitative indicator of the accident rate.

3. Some of the emergency streets have places of the accident concentration with a small dispersion of accidents by year. Usually, these places have permanent (stationary) or temporary factors and conditions that contribute to the dangerous behavior of drivers and pedestrians and create conflict situations (\( N_{ks} \)). These factors and conditions can be visually identified and eliminated by specially selected events. This conclusion indicates the possibility of systematic reduction of the number of accidents in specific places of accident concentration. We can assume that, by eliminating the identified hazards in a particular area, the average annual number of accidents will be reduced by at least 50%.

3. **Conclusion**

The proposed approach makes it possible to systematically reduce the annual number of accidents on a specific street-road network due to the targeted selection of measures to eliminate specific hazards and conditions that cause road accidents at specific locations of their concentration. This approach makes it possible to indirectly influence the program indicator “the number of people died in road accidents for the reporting year” and ensure the fulfillment of the indicators established by federal regulatory documents. Moreover, a prerequisite is to conduct a systematic preventive work with various social groups.

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