The Use of Information Technology in Territorial Planning of a Subject of the Russian Federation

S G Sheina, K V Chubarova, I V Girya, L A Seferyan*

Don State Technical University, 1, Gagarina sq., Rostov-on-Don, 344000, Russia

E-mail: Rgsu-gsh@mail.ru

Abstract. To date, the most important task in the modern Russian cities’ development is the formation and maintenance of an environment favorable and comfortable for the population. The authors of the article describe the main problems and directions of the construction industry and territorial planning modernization in the Russian Federation. The article details the national project “Housing and Urban Environment”, its goals and objectives, analyzes one of the project’s priority areas - the state program “Formation of a Comfortable Urban Environment”, developed for the period from 2018 to 2024. A drawback of the existing methodology for assessing the urban environment quality in terms of assessing the environmental situation is noted. An example of the alternative methodology implementation for calculating the habitat quality index for a site in the city of Rostov-on-Don, which takes into account the environmental pollution factors in more detail, is given.

Introduction

Construction is one of the leading and dynamically developing sectors in the economy of the Russian Federation. However, despite the current growth indicators, there are many problems of the construction complex, such as the lack of funding, poor management and poor work organization. One of the priority areas in the current conditions is the industry modernization and the construction quality improving. The main objectives of modernization according to the order of the President of the Russian Federation No. Pr-1235 of July 19, 2018 are:

- transition to the life cycle management system of the capital construction projects by implementing the information modeling technologies;
- the standard control system models’ application;
- the management system performance indicators’ approval;
- the information modeling standards’ adoption.

To ensure more efficient coordination of the territorial planning draft documents in the Russian Federation at various levels, as well as information support for decision-making in the field of urban development, the Federal State Information System for Territorial Planning (FSIS TP) was developed (Figure 1) [1,2]. This system is an information resource that includes the spatial data on the use, restrictions on use and planned development of the territories, which makes greater transparency of processes for managing the development of the territory possible.
Figure 1. Digital Urban Development Platform - Federal State Information System for Territorial Planning

Materials and Methods
One of the important steps towards the modernization of the construction industry, improving the quality and living conditions of the Russian population is the implementation of the national project “Housing and Urban Environment”, developed by the Ministry of Construction of the Russian Federation and includes the four areas (Figure 2):
Figure 2. Directions of the national project “Housing and urban environment”

The multi-purpose nature of the national project involves an integrated approach to solving the most important problems in the field of the population life quality (Figure 3), such as:

- increase in housing commissioning;
- gradual abandonment of the shared construction in favor of other less risky instruments for financing the housing projects for citizens;
- efficient land use;
- the green fund and natural territories’ conservation;
- integrated urban development.

Figure 3. Goals and targets of the national project “Housing and urban environment”
As a part of the one of the directions’ implementation of the national project, in March 2019, the Government of the Russian Federation approved a methodology for the formation of an urban environment quality index, which includes 36 indicators combined into 6 groups or assessment criteria. A comprehensive assessment of this indicators set characterizes the comfort of living in the study area [3,4].

A significant drawback of the existing methodology in terms of the urban environment quality is the lack of the environmental situation consideration [5]. This assessment criterion should characterize the ecological territory compatibility, however, it is worth noting that the indicators contained in it describe the ecological state of the study area only indirectly and do not contain any specific information about the current environmental pollution, which, undoubtedly, has a significant impact on the population life quality and the environmental quality in general.

As a part of conducting the research on the sustainable development of built-up territories from the standpoint of environmental comfort, as well as providing the conditions for improving the population life quality and comfort, the scientists at the Department of Urban Construction and Economics of DSTU developed a comprehensive program to increase the level of environmental comfort for living during landscaping and greening the built-up territories. The main goal of the program is to consistently bring the environmental comfort of living in all the reconstructed urban areas to a relatively favorable level and higher [6]. The comprehensive program is based on the reconstruction area urban ecological passport’s development and the use of modern GIS technologies.

The urban ecological passport is an electronic database created with the use of electronic mapping tools based on the urban planning results and geological and environmental analysis of the reconstruction area, and also includes the habitat quality index calculation and the recommended set of measures for improving the territory.

The habitat quality index is an integral indicator quantitatively characterizing the life ecological comfort level and calculated on a number of the territorial ecological condition indicators (Figure 4) [7].

| P1 - Air Pollution Index (API) |
| P2 - Dust mass kg / m2 per day |
| P3 - Noise load dB |
| P4 - Water pollution (WP),% |
| P5 - The total indicator of soil pollution, Zc |
| P6 - Solid waste pollution |
| P7 - Radiation pollution m3v / year |
| P8 - Drinking water pollution, % |
| P9 - The state of green spaces |

**Figure 4.** The classification of environmental indicators used to calculate the environment quality index

In order to provide the informational and analytical support for environmental monitoring of the programs for the urban areas’ comprehensive improvement implementation, an informational model to increase the life environmental comfort level [8] was developed, which allows:
to conduct the built-up territories zoning according to the living environmental comfort parameters;

- to identify the most dangerous in terms of the pollution level and the territorial ecological condition;
- to record the built-up areas eco-monitoring results on an electronic map;
- to simulate the implementation of a comprehensive program for the urban areas’ improvement and to evaluate the effectiveness of various activities under this program using the spatial analysis method.

Results

As an example of these methods’ implementation, a comprehensive assessment of the urban ecological situation was carried out in the area intended for the placement of the new housing projects in the city of Rostov-on-Don. The site is located in the Leninsky district, in the central part of the city near the main railway station [9]. The electronic maps’ fragments with zoning according to the studied indicators for the site are shown in Figure 5.

The data given in Table 1 allow us to state that the most unfavorable situation on the site is with the air pollution level, the dust deposition amount, as well as with the degree of soil pollution. In addition, the most polluted section of the Temernik River flows near the site and there are five spontaneous city dumps. For the most part, the landscaping system in the site is in satisfactory condition, however, the total landscaping density is insufficient and does not meet the regulatory values, which is typical for the areas located in the city center (Figure 6).

It is worth emphasizing that green spaces are the most important component of the natural framework and have a healing effect on the territorial ecological condition.

The landscaping system makes it possible to reduce the dust pollution level, improve the atmosphere condition, soils, groundwater, has a positive effect on the microclimate and thermal regime, and also directly participates in the formation of the perception by the residents of the architectural appearance in the city. All these factors are extremely important in solving the environmental quality problems of the modern cities [10, 11].

Based on the analysis results, the habitat quality index for the selected reconstruction territory was calculated, and then the index change modeling as a result of the territorial comprehensive landscaping and greening implementation was performed. The simulation results are presented in Figure 6.

The simulation results confirm that most of the reconstruction territory can be led to the favorable or relatively favorable level of the habitat quality index through the implementation of measures for comprehensive improvement and landscaping. From Figure 3 of Table 2, it can be noted that for a significant part of the study area, a set of landscaping measures will be sufficient M113, which includes the single-row and multi-row planting of plants and shrubs with bringing the total density of landscaping on the site to standard values. The implementation of this landscaping measures set is an effective and relatively low-cost way to improve the urban environment quality.

Thus, it is obvious that the forecasting changes in the quality index of the environment using modern GIS technologies is a fairly visual way of demonstrating the environmental comfort expected dynamics in the territory and greatly simplifies the management decisions in the comfortable urban environment’s formation [12].
Figure 5. A comprehensive assessment of the urban ecological situation in the reconstruction area.

Figure 6. The main characteristics of the landscaping system in the city of Rostov-on-Don.
Habitat Zone

- favorable
- relatively favorable
- unfavorable
- extremely unfavorable

| 1) | The initial state of the reconstruction territory is an unfavorable, extremely unfavorable zone |
| 2) | The state of the reconstruction territory after the landscaping $M_I$ |
| 3) | Condition of the reconstruction territory after greening $M_{II}$ |
| 4) | The state of the reconstruction territory after additional improvement measures $M_D$ |

**Figure 7.** Modeling the index of the environment quality in the reconstruction area during the measures for comprehensive improvement and landscaping implementation

Zoning according to the environment quality index is undoubtedly an important step in deciding on the further territorial development, especially when choosing the territories for housing construction, since it assesses the environmental indicators of the territory that are extremely important for the health and comfort of the population. The introduction of this index calculation according to the methods described by the authors [13] into the methodology for calculating the urban environment quality index as a separate indicator proposed by the Ministry of Construction will make this index more correct from the standpoint of taking into account the environmental factors that directly affect the health of the citizens.

**Summary**

The existing state programs and directions of the national project “Housing and Urban Environment” are aimed at the comprehensive solution of a large number of tasks related to improving the population life quality in the Russian cities. In addition to solving the most acute problems associated with providing the people with affordable housing, a stable reduction in emergency housing and creating a comfortable urban environment, these programs also include the gradual modernization of the entire construction industry, the modern geographic information systems’ introduction and the information modeling tools in the territorial planning and development management system territories.

The use and implementation of the habitat quality index proposed by the authors and the methods of its modeling using GIS technologies into the existing methodology for calculating the urban environment quality index of the Ministry of Construction of the Russian Federation will make it possible to assess the real comfort of the population more effectively, as well as to propose the effective measures to improve the environmental situation in the study area.
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