The ecological concept of the Rostov-on-Don former airport territory’s renovation from a position of sustainable development

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Abstract. Today, the most important task in the modern Russian cities’ development is the industrial territories’ renovation to identify the areas and ways of adapting the industrial territory to the life of a modern city and the needs of its citizens. Sustainable development of these territories is carried out, in particular, using the renewable energy sources in order to save energy and reduce harmful emissions into the atmosphere, achieving the ecological balance in the territory. The authors of the article described the main problems and directions of the old city airport territory renovation. The purpose of the work is to identify the environmental problems of renovating the territory of the former airport in Rostov-on-Don and propose the measures to reduce their negative effects on the environment. Tasks: to identify the main problems of the industrial sites’ renovation, to analyze the territory of the former airport, to offer a range of organizational and technological measures. The content of the article is of scientific and practical interest, it contributes to the theoretical basis of the organizational and technological support for the industrial territories’ renovation on the basis of environmentally oriented solutions.

1 Introduction
Industrial territories were born in Rostov-on-Don in the second half of the 18th century. The first industrial enterprise in Rostov is considered to be a brick factory built in the area of the Kiziterinki gulch, which was built in 1761 at the direction of engineer Alexander Rigelman. In the pre-war era, the expansion of the city led to the inclusion of industrial territories in the structure of the city. During the industrialization period, existing and expanding new industrial enterprises are expanding in Rostov, including in 1929 – Rostselmash; 1939 - Rostvertol, 1925 - the airport of federal significance. Due to the peculiarities of its formation, many factories were located outside the city. The borders of the city started expanding over time. During the period of the territory mass development beyond the borders of industrial zones, residential quarters started being built up. Today there is a picture when the industrial and communal-warehouse areas were between the central part and the “sleeping” quarters.

Sustainable development of such territories is achieved, in particular, by using renewable energy sources in order to save energy and reduce the harmful emissions into the atmosphere and achieve the ecological balance in the territory. [1-3]

2 Materials and Methods
Former industrial areas often need environmental intervention; ecological renovation is carried out in two directions:

1. Territory renewal - the former industrial zone is planted with greenery, measures are being taken to reorganize the territory, thanks to which its protective qualities become an order of magnitude higher;

2. Reprofiling is carried out under the condition of reducing all types of impact on the urban environment with chemical and biological effects to the maximum permissible concentration (MPC) and the influence of physical factors, taking into account the background of the maximum permissible level (MPL);

Both of these areas can be applied simultaneously for the enterprises that do not fully use their territory and enterprises that continue to operate on a smaller area; the liberated one undergoes landscaping. Thus, there is an improvement in the environment quality and it becomes possible to use the vacated territory for the new construction needs.

**Figure 1. The main environmental problems, renovation of industrial areas**
3 Results

The projects for the integrated development of the territories of Rostov-on-Don involve the renovation of city industrial zones, including their removal beyond the city limits of the airport. In the liberated territory, the construction of the Aviator residential complex is planned. Architect Anthony Besu developed the basis of the project concept. In the new district, residential buildings, kindergartens, schools and clinics will be built as well as the objects of trade and consumer services, recreational areas, sports and playgrounds. A feature of this territory will be a large walking area in the area of the airport runway.

An analysis of the former airport territory showed that vehicles are the main source of noise pollution. The highway of Sholokhov Avenue is located near the micro district under construction. Here, the traffic flow is characterized by high intensity and the presence of a large number of traffic lights, which create traffic jams, which leads to an increase in engine noise. [4-6]

The level of environmental risk, depending on the type of infrastructure, was 3 and 5 points, which corresponds to the hazardous and low-hazard zone (Figure 2), in this regard, it is necessary to develop the additional organizational and technological measures, which include the zonal-territorial and local ones, to preserve and reduce environmental risk. [7]

a) Total soil pollution - average pollution

b) Low air pollution

Figure 2. The territory of the former airport the current situation
Figure 3. Environmental indicators of the Aviator residential complex

The “Aviator” residential complex will increase CO₂ emissions, use a huge amount of energy, water, and also produce large amounts of waste. It is at the pre-investment, design and construction stage that these problems should be addressed, while at the operational stage it will be impossible to achieve large effect. [9-10] To minimize the environmental risks and reduce their negative effects on the environment, a set of measures is proposed, including:

1. Area-territorial methods.

Technical Activities:
- the use of vibration-isolating sidewalks;
- the use of environmentally friendly materials in the buildings’ maintenance.

Planning events:
- landscaping;
- green care;
- habitat monitoring - tracking the living environment parameters, the degree of pollution, i.e. deviation from normative indicators.

Organizational activities:
- organization of green spaces’ systematic watering in summer;
- ensuring the containerization of garbage, to prevent multi-day concentration of the household waste and regularly remove it;
- removal of snow and ice from the driveways and passages in the winter;

2. Local methods.

Constructive measures:
- use of double-glazed windows;
- use of central air conditioning;
- use of an air purification system;
- the use of soundproof or sound absorbing exterior walls;
- the use of interior walls with sound-absorbing, sound-and vibration-insulating materials.

Also, in order to achieve the sustainable development indicators within the framework of the territory renovation, a set of measures for energy conservation using the alternative energy sources and the introduction of green standards is proposed at the facilities under construction, shown in Figure 3. All this will create a unified natural framework on the territory and restore the natural environment.

![Figure 4. A set of energy-saving measures for the airport renovation](image-url)
An analysis of the environmental problems of the former airport territory renovating in Rostov-on-Don showed that when developing these territories, it is necessary to provide a set of measures for improvement and landscaping, to introduce the energy-efficient technologies during the construction and use the environmentally friendly materials, the restriction on CO₂ emissions, and other initiatives that will improve the environment in the city, should be implied.

Summary

To increase the level of responsibility for the environment state, in particular, during the construction of social facilities, kindergartens, schools and educational institutions, it is recommended to use eco-technologies, including the engineering systems that save energy, with a demonstration of their ability to reduce harmful emissions into the environment and reduce operating costs.

Thus, the environmental situation of the former airport territory in the city of Rostov-on-Don is analyzed, the directions and ways of adapting the industrial territory to the life of the modern city and the needs of its citizens are identified. The impossibility of improving the indicators of the urban environment state does not mean that there is no point in improving the situation, and the successful experience of European practices in renovating urban areas demonstrates this.

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