Experience of reorganization of depressed industrial areas

M V Perkova¹, M Yu Drebezgova¹

¹ Belgorod State Technological University named after V.G. Shukhov, Russia, 308012, Belgorod, Kostukov Street, 46
E-mail: perkova.margo@mail.ru

Abstract. Historic industrial sites and their territories present the integral part of urban environment. Depressive industrial territories in cities need reorganization and transformation, since they do not correspond to the modern requirements for the development of territory and destroy the image of cities. The paper studies the prerequisites and problems of the reorganization of industrial territories, as well as the examples of successful reorganization of industrial facilities depending on their location in urban structure: in the historical center of the city, in industrial zones in city outskirts, reorganization of quarries and dumps distantly located from city structures. Three types of reorganization of depressed industrial territories were identified, depending on the degree of preservation of industrial functions: reorganization with preservation of industrial functions, partial re-functionalization and complete re-functionalization. The applicability of the ways to reorganize various industrial sites against the identified types of depressed industrial areas is evaluated.

1. Introduction
Today the topic of reorganization and transformation of industrial zones becomes more and more acute. Historically industrial zones generally formed in the central part of cities do not meet modern development requirements and destroy the image of cities as an integral architectural and urban planning formation, limit the possibilities for the development of the territory, reduce economic and urban planning value of lands and aggravate the ecological situation in cities. However, the depressing industrial zones of cities present a potential resource for the development of urban areas, construction of housing, business and shopping centers and recreational areas. This is a significant land reserve, which can make it possible to correct the deficit in building areas in the central part of cities.

Historic industrial sites and their territories present an integral part of urban environment. There is no doubt that it is necessary to understand the meaning and content of the industrial territories subject to reorganization, to assess their transformation over time in the implementation of federal and regional programs and strategies [1]. Almost all industrial enterprises of the 18th - early 20th centuries are monuments of architecture, and the problem of their preservation and subsequent operation is one of the most urgent.

Today, there are urban contradictions in the development of such territories [2]. In this regard, it is necessary to determine the existing conflicts between participants in urban planning activities (land use, social and functional activity, transport, regulatory, property) and search for a compromise in solving problems of renovation of the existing buildings [3].
2. Materials and methods

The theoretical and methodological basis of the study is presented by conflictological approach, which allows studying the cultural and historical process, the period of industrialization and the processes taking place on the territory of industrial enterprises at the present stage of development of society. In addition, it makes it possible to identify the interests and needs of participants in urban planning activities and to find a compromise that allows not only creating a comfortable living environment but also preserving nature. The research is based on a comprehensive study of the process of adaptation of industrial zones in the context of changes in urban planning system and socio-cultural priorities.

3. Reorganization of depressed industrial areas

At the end of the 19th and the beginning of the 20th centuries, in big cities around the world, the main city-forming factors were industrial and transport enterprises, where citizens worked and lived in a close proximity (from 70 to 80%). As a result of the constant increase in production capacity, industrial areas increased and residential areas appeared within the production zones. Such buildings were typical for densely built-up cities of Russia and Europe.

During the research, it was found that the first problems of irrational use of industrial areas arose in 1970, when technology was intensively developing. Then there was a decline in industrial production: the shutdown of factories, their disrepair or re-equipment into non-industrial premises. In 1990, the profitability of traditional industrial production fell and the demand for non-industrial use of sites and premises in the centers of big cities increased. Coastal industrial areas also suffer from mismanagement, as industries often developed along rivers. With the development of cities, the requirements for ecological situation increased and a conflict between industrial and recreational zones arose [4]. The need to adapt industrial facilities and integrate them into the modern urban and social environment appears.

Thus, the non-compliance of industrial enterprises with modern requirements leads to the need to reorganize industrial territories [5].

The prerequisites for the reorganization of industrial territories are as follows:

- **Architectural planning** (insufficient density and intensity of use of industrial areas; low architectural and aesthetic quality of industrial buildings; convenient location of industrial areas in the city structure; shortage of residential and public spaces, especially in the central districts of cities);
- **Administrative and legal** (non-compliance with modern urban planning requirements, a fairly high level of environmental impact);
- **Management prerequisites** (the tendency to reduce large industrial facilities with the development of small and medium-sized enterprises, new forms of management and economic models);
- **Technological prerequisites** (development of new high-tech enterprises in smaller industrial areas and spatial production models - mixed use zones, industrial parks and technology parks [1]).

For city-forming industrial territories, the best land plots were usually allocated from the city fund, which were within transport accessibility to cities or settlements with developed infrastructure. However, during the reorganization of these territories, a number of problems arise, such as:

- Lack of clear government programs and administrative procedures for working with industrial sites (decisions are usually made on individual basis).
- Higher economic costs compared to new construction.
- The presence of several owners with different plans for its reorganization.
- Deterioration of engineering networks.
- Environmental problems [6].

Foreign and Russian experience in the adaptation of degrading industrial areas in the historical environment allowed determining the main potential of industrial zones in order to adapt to modern urban conditions, as well as diverse and interrelated problems of adaptation - environmental, security and rehabilitation, aesthetic, design, construction, economic, environmental and organizational ones [7]. There are various ways of renovation and reorientation of industrial areas to meet modern requirements. The results of such design solutions are public spaces in the form of commercial
premises, creative clusters aimed at the development of the territory, as well as residential complexes and apartments with increased level of comfort and life support.

In the course of the research the authors consider the examples of successful practices of the reorganization of industrial facilities [8] depending on their location in urban structure: in the historical center of the city, in industrial zones in city outskirts, reorganization of quarries and dumps distanty located from city structures (Figure 1).

**Figure 1.** Examples of reorganization of depressed areas in the historical center of the city, in industrial zones in city outskirts and reorganization of quarries and dumps

### 3.1. Reorganization of objects in the historical center of cities

**Complex of Gas Meters (Vienna, Austria),** built in 1896-1899 for the Gaswerk Simmering gas plant, and was used as gas storage tanks. Later, from 1984, the city enterprises switched to natural gas and gas meters were no longer used until 1995, when a competition for the reorganization of gas meters was announced, as a result of which architects Jean Nouvel, Manfred Vedorn, Wilhelm Holzbauer and the architectural bureau Coop were involved in the development of design solutions. The opening of gas meters in new functional zoning was in 2001. The project provides the division of gas meters into a residential area, office and retail and entertainment areas while preserving the historical exterior of the building. The complex of gas meters also includes a student dormitory (70 rooms for 250 students), a cinema, a concert hall (for 2,000-3,000 people) and an archive [9].

**Design factory FLACON (Moscow, Russia),** is a trade, exhibition and office complex with a total area of 25 thousand m² in the Butyrsky district of Moscow on the territory of the former Kalinin Crystal Factory. In 2005 it was bought out, but only in 2009 the replacement of the infrastructure of buildings and utilities began along with the removal of obsolete production equipment and the
cleaning of the plant territory. In 2010, the complex was completely reoriented. Various advertising agencies and design studios and craft workshops are located on its territory [10]. For various events, the complex has three specialized sites. The first one is The Cube. It occupies the space of one of the workshops and includes an exhibition and conference hall. The second site is focused on cultural and educational events and located in a separate building of the complex. The third area is used for small events. On the territory of the FLACON plant, there are also two coworking spaces: Flacon Coworking and Start Hub (positioned as a “business accelerator” or “business incubator”).

Foundry Garden (Nantes, France) is a 350 hectare complex located on the island in the center of Nantes, on the site of the former Fonderies Atlantique, which produces propellers for sea liners. The reorganization project was based on the principles of maximizing the use of existing buildings without demolition, as well as preserving the social environment, historical and geographical heritage. The main objectives of the project were to create a covered public space (“roof garden”) for daily operation and show of preexisting industrial activities. The roof and surrounding buildings protect the garden from adverse weather conditions, resulting in a “greenhouse effect” that allows exotic plants to be grown. They are irrigated with rainwater collected in tanks (2x50 m³) and distributed through various irrigation networks. Moisture and freshness is maintained by misty spraying of plants [11].

Multifunctional center «Manufaktura» (Lodz, Poland) - the center, which opened in 2006, is a shopping and entertainment complex that has preserved the historical atmosphere of this place and the original industrial architecture (project of the Lodz architect Hilary Majewski, 1872), with a total area of 27 hectares. It is located in the central part of Lodz. There are a restaurant complex, parking lots, a cultural and entertainment center, including a multiplex cinema, a bowling alley, a climbing wall, a fitness club and a skate park on its territory [12]. The project of the complex was developed by the British firm Virgile & Stone (London) together with the French architects from Sud Architectes (Lyon).

3.2. Reorganization of objects in industrial zones in city outskirts
Shanghai Houtan Park (Shanghai, China) is located in the abandoned industrial area along the banks of the Huangpu River in China, on a 14 hectare, 1.7 km long and 30 - 80 m wide. The goal of the project was to restore the coastline and clean up the polluted river. Previously, the park placed a steel mill, and in recent years it has been used as a garbage dump. The Shanghai Houtan Park project was designed to accommodate a large flow of visitors during Expo 2010, with the option of converting into a public park after it. The central part of the park is decorated with cascades and terraces with a variety of plants capable of absorbing water polluting elements, saturating the air with oxygen. They are designed to compensate the apparent elevation difference between the city and the river. The surviving structures of the former steel mill have been converted into hanging gardens and viewing decks [13].

Keystone Industrial Port Complex (KIPC) (Fairless Hills, Bucks county, Pennsylvania) is a “green industrial complex” located on the territories of a by-product coke, steel and chemical plant, power plant and others. Since these industries were highly polluting, in 1993, a joint agreement was concluded between the US EPA and the US Steel Fairless Works to clean up the areas with the purpose of developing new industries and creating jobs. The reorganization of the site consisted in the processing and reuse of coal dust, scrap metal, land reclamation, the production of electricity from landfill gas, the development of renewable energy production, that is, the sustainable development of the US EPA enterprise in order to improve the environmental and economic performance in relation to the consumption of natural resources and the use of energy of man-made raw materials [14].

3.3. Reorganization of quarries and dumps distantly located from city center
Inter Continental Shanghai Wonderland Hotel (Shanghai, China) is located 30 km from the center of Shanghai on the site of an abandoned quarry, close to the Sheshan Mountain National Forest Park and the Chengshan Mountain Botanical Garden. The hotel building consists of three volumes, made of glass and metal, which are tightly adjacent to the wall of the quarry. The 18-storey complex with 336 rooms includes public areas and conference rooms, as well as an underwater restaurant under the
artificial lake at the bottom of a quarry and the artificial waterfall on a sheer wall. Its central part is a glass tower resembling a waterfall with an elevator and an upper observation deck. The exploited roof has mini-gardens and sports grounds.

Sport Complex «White Well» (Voronezh, Russia) is the complex of motor sports located 12 km from the city of Voronezh in a chalk quarry. It has existed since 2003. On the territory of the sports complex, car tracks are designed. There are beach volleyball courts. Fishing sites are organized on the chalk lake, and rock climbing is expected on the steep walls of the chalk quarry [15].

As a result of the study of world practices for the reorganization of industrial zones, three types of reorganization of depressed industrial areas were determined, depending on the degree of preservation of the industrial function: reorganization with the preservation of the industrial function, partial re-functionalization and complete re-functionalization (Figure 2).

![Types of Depressed Industrial Areas](image.png)

**Figure 2.** Types of depressed industrial areas developed by M.Yu. Drebezgova

4. Conclusion

1. The authors considered the examples of successful practices of reorganization of industrial facilities depending on their location in urban structure: in the historical center of the city, reorganization of facilities in industrial zones in city outskirts, reorganization of quarries and dumps distantely located from the city structure.

2. Three types of reorganization of depressed industrial areas were identified, depending on the degree of preservation of industrial functions: reorganization with preservation of industrial functions, partial re-functionalization and full re-functionalization.

3. The applicability of the ways of the reorganization of industrial sites against the identified types of depressed industrial areas was assessed:
   - for the territories in the historical center, the most applicable way is full or partial re-functionalization;
   - for the sites in industrial zones in city outskirts the most applicable way is partial re-functionalization (while maintaining the existing industrial function and replacing it with a new industrial function);
   - for the reorganization of quarries and dumps distantely located the city structure, the most applicable way is complete re-functionalization in the form of environmental rehabilitation with the possible arrangement of recreational areas, leisure facilities and sites.
5. Acknowledgements
This work was realized in the framework of the Program of flagship university development on the base of the Belgorod State Technological University named after V G Shukhov, using equipment of High Technology Center at BSTU named after V. G. Shukhov.

References
[1] Shikovets A V 2018 Preconditions for the renovation of industrial territories in the neighboring countries Science - education, production, economy: materials of the 16th International Scientific and Technical Conference (Minsk: BNTU) 2
[2] Perkova M V, Vitens A G and Baklazhenko E V 2018 Classification of urban planning conflicts Bulletin of BSTU named after V G Shukhov 12 pp 83–90
[3] Perkova M V 2018 Methods for identifying and resolving urban planning conflicts and contradictions in development on the example of small towns in the Belgorod region Bulletin of BSTU named after V G Shukhov 9 pp 74–84
[4] Perkova M V and Krushelnitskaya E I 2016 Recreation and tourism organization issues in modern urbanization conditions International Journal of Pharmacy & Technology 8 (4) pp 24919–24929.
[5] Topchiy D V 2008 Reconstruction and re-profiling of industrial buildings Publishing house of the association of building universities pp 3–6
[6] Chadovich A A 2013 Preservation or demolition? Compromise! Architecture and Modern Information Technologies (Moscow: MARHI) 1 (22) pp 34–47
[7] Perkova M V, Blagovidova N G and Tribuntseva K M 2015 Features of Design of Ecovillages in Depressed Areas in the City Research Journal of Applied Sciences (10) pp 608-619
[8] Drozhzhin R A 2015 Renovation of industrial territories Bulletin of the Siberian State Industrial University 1 (11) pp 84–86
[9] Sasi Yu 2009 Life in the Gasometer Vienna: The History of the City / per. with him. E. Krivtsova (Moscow: Eksmo) pp 210–225
[10] Grishin N 2013 Creative meters Secret of the firm 3 (328) pp 34–39
[11] ADH & Hervé Abbadie. Foundries’ Garden [Electronic resource] access mode: http://www.landezine.com/index.php/2009/09/foundries-garden/ (date of access 05.06.2019)
[12] Kondratieva S How to turn a closed plant into the liveliest place in the city [Electronic resource] strelkamag.com. Access mode: https://strelka.com/ru/magazine/2017/01/31/lodz-case (date of access 06.06.2019)
[13] Houtan Park. Turenscape Landscape Architecture [Electronic resource] landezine.com - access mode: http://www.landezine.com/index.php/2011/02/shanghai-houtan-park-by-turenscape/ (date of access 06/02/2019)
[14] Keystone Industrial Port Complex [Electronic resource] Western Pennsylvania Brownfields Center - access mode: http://www.cmu.edu/steinbrenner/brownfield (access date 01.06.2019).
[15] About the sports complex [Electronic resource] Sports complex "White well" sportkompleksbk.ru - access mode: http://sportkompleksbk.ru/history.html (date of access 06.06.2019)