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## TERRITORIAL RESERVES OF MAJOR CITIES: CHALLENGES, EXPERIENCE, SOLUTIONS

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### Abstract

Currently, the problem of territorial reserves is quite relevant for dynamically developing urban systems, since a large city feels an increasing need for the new development resources such as areas, infrastructure, water sources, etc., but many of them turn out to be exhausted or close to exhaustion within the urban area.

This paper deals with the approaches to the problem of deficit in areas within the city limits based on the analysis and generalization of the world and Russian experience in the urban planning policy.

Practice has shown that the territorial problems in cities may be solved by increasing the area of the city, urban densification, demolition of buildings and structures, by transferring industrial enterprises outside the city margin, high-rise construction, by creating filled (reclamation) areas, and underground construction.

The paper deals with the features, advantages and disadvantages of the considered approaches to the designated problem of land shortage within the urban area. Considerable attention has been paid to environmental issues arising out of the implementation of any variant of solving the territorial problems of the city.

The study found that the decision of the territorial deficit in the process of urban development has a complex nature. To achieve the best effect, it would be appropriate to use the combinations of various approaches, covered in this paper, in the urban planning practice.

**Keywords:** city, territorial reserve, building sealing, demolition of buildings, high-rise building, underground structures.

### 1. Introduction

A high level of urbanization, growing urban population, inefficient and congested infrastructure, and increasing number of vehicles cause shortage and deficit in areas in urban systems. At the present stage of development, many

cities have a need to review and adjust some of the principles of urban planning from the point of view of a rational economic use of territorial resources and environmental safety. Many countries have experience in dealing with the identified problem. Solving the problem in a certain country is defined both with historical reasons and with its level of socio-economic development and the resulted urban policy. Objective of this research is to study the methods of addressing the deficit in areas, applied in different countries, and to define the most appropriate of them.

## **2. Methods**

The research is based on the theoretical methods: analysis, synthesis, scientific generalization.

Empirical analysis of the disparate actual and literary material revealed a range of existing methods of solving the problem; the structural and genetic synthesis allowed us to establish cause-and-effect relationships, identify patterns in addressing the deficit in urban areas. Scientific generalization allowed us to find a single in a diverse, a common in a singular, a regular in a random, as well as combination of objects by similar properties.

## **3. Results**

There are several approaches that solve the problem of land shortage within the urban area: an increase in the urban area (development of new territories), urban densification, demolition of buildings followed by the construction of new, more spatial and high-quality housing, transfer of industrial enterprises outside the city margin and the following development of free territories, high-rise construction, creation of artificial territories, and underground construction. Let us consider these ways of overcoming the shortage of urban land in more detail.

### *Increase in the urban area (development of new territories)*

The gradual expansion of the city with increase in its population is unavoidable to a certain stage of its development. A dynamically developing large city feels an increasing need for the new development resources such as areas, infrastructure, water sources, etc., but many of them turn out to be exhausted or close to exhaustion within the urban area [1].

However, the perimeter spread is not infinite and has its reasonable limits. It should be noted that the development of new areas for urban development is associated with additional costs caused by the need to create infrastructure (sewerage, water conduit, gas supply, electricity, etc.), and construct the traffic arteries in the merged areas. In addition, urban sprawl is accompanied by a set of negative environmental, social, and economic consequences, among which are a complicated possibility of rapid movement from one point to another, i.e., loss of connectivity of a city; an increased load on the highways, resulting in traffic jams; an increased intensity and conflict of land use; the

risk of degradation of the urban environment in the peripheral areas; the remoteness of a city center from the natural "green" environment, the destruction of ecological framework; transfer of agricultural and forest land in the category of residential land; increased intensity of anthropogenic influence (pollution of air, natural water, the need for waste disposal); and the aggravated problem of supplying the population with high-quality drinking water [2, 3, 4]. Thus, an unhindered expansion of urban boundaries cannot be a factor contributing to the sustainable development of the territory [5]. Currently, a strategy of a "compact city" is spreading widely, allowing more efficient use of territorial resources through the maximum possible use of urban development.

### *Urban densification*

Urban densification is understood to be an increase in the amount of living space per unit of area in terms of reconstruction of existing buildings. A synonym for densification is an "infill development". Currently, the urban planning legislation of the Russian Federation defines no procedure of "infill development". Infill development mismatches the general urban development plan. The need for it is usually due to the desire of an investor (a development company) to save money on the construction of communications (water supply, energy supply) and the roads to the construction site rather than due to the interests of the inhabitants. Infill development brings additional problems into a routine life of a district and is accompanied by a number of negative consequences, among which we should note an increase in the load on the transport infrastructure, aggravation of the availability of the districts and parking areas (the existing parking areas cannot accommodate additional number of vehicles); discomfort to local residents as a result of machine operation directly during construction; the destruction of green areas; increased load on the existing utility network that may lead to emergency situations in the water and electricity supply; and the risks for the constructions of the neighboring houses. However, despite these consequences, the city can hardly go without densification, because in already developed areas a need arises periodically to update the housing stock and to build objects of social infrastructure (schools, nursery schools, clinics, parking areas, etc.), which will be the elements of infill development.

### *Demolition of buildings followed by the construction of new, more spatial and high-quality housing*

This approach allows finding reserves in urban areas, as well as solving the problems caused by natural aging of buildings and structures. However, the urban buildings should be demolished with great caution in respect of cultural heritage sites, which are located mainly in the city center - its most active and busy part. An inevitable modernization of the cultural heritage sites must meet the requirements of a developing city, which according to the Law of the

Russian Federation on cultural heritage sites [6] in terms of "the creation of conditions for the modern use of the site",

specifies the main types of work with the sites of architectural heritage, consisting in the increased comfort (adaptation), as well as reorientation (conversion). The above activities contribute to the preservation of historic buildings, firstly, by increasing the utilitarian value of the monument, secondly, through more efficient recovery of the historical, urban planning, and emotional values [7].

#### *Transfer of industrial enterprises outside the city margin and the following development of free territories*

A significant reserve of the territories in old cities is the transfer of industrial enterprises outside the city margins. It is known that the average industrial facilities cover an area of 5 - 10 ha. In the major Russian cities, industrial zones account for 15 - 20% of the total area [8]. Industrial sites, located in the central parts of cities, require a serious land reclamation and costs for transfer of existing facilities in the peripheral areas. The positive moments are the lack of problems with the infrastructure, as well as the possibility of populating the new areas with socially homogeneous residents. This process can be exemplified by the construction of a residential complex in St. Petersburg in the territories previously owned by the plant "Vulkan", as well as a business center instead of the factory "Rossiianka".

According to the general plan of the city of Kazan it is supposed to limit the development of industrial areas within the city, and accommodate production facilities in the proposed new site in the northern part of the existing borders of the city. The first steps in the implementation of these plans have been already implemented: in the very center of Kazan - between Shcherbakovsky and Shkolny Lane, in 2.4 ha area of the former Kazan confectionary factory "Zarya", the first phase of RC "Clover House" - a 26-storey house with a total apartment area of over 30 thousand m<sup>2</sup> - has been completed.

The implementation of this direction of territorial development of cities along with the rational use of the territories has positive impact on the environmental situation in the city.

#### *High-rise construction*

High-rise construction originated in the USA in the late XIX century, which was promoted by the introduction of steel-framed buildings having replaced the heavier cast iron ones. In 1883, in Chicago, a 55 m 10-storey building "Home Insurance Building" was constructed, which is the first high-rise building in the world [9].

High-rise construction in Europe started developing a bit later - at the end of the 1950s - beginning of the 1960s, which was due to the need to restore the destroyed residential buildings after the Second World War. We should note that the major cities of Europe had certain principles of building construction formed, consisting of inadmissible

construction of skyscrapers in the historic part of the city, as well as the combination of high-rise office buildings with low residential ones [9].

In addition to Europe, in the 1970s, high-rise building was developing in Japan due to the acute shortage of areas for the development of large cities. Later, in 1990s, against the backdrop of increasing economic prosperity in Asia, an active construction of skyscrapers took place in the United Arab Emirates, China, and Singapore [10].

The formation of high-rise construction in the USSR and in Russia can be divided into 3 periods, due to the peculiarities of the state urban policy in different eras.

The first period (after the Second World War) was characterized by the fact that for the faster restoration of destroyed towns a concept of residential development was developed, which implied depreciation of building materials, and unification and typification of prefabricated elements. The result was a vast scale of building the standard low-rise blocks. However, in 1947, the construction of 8-storey buildings was begun in Moscow ("Stalin's skyscrapers"), where a variety of technologies innovative for that time were implemented, the buildings were built by the frame method. The second period was characterized by the decline in high-rise construction in the USSR. At that time, low-rise construction was common to Moscow, while high-rise projects were rare.

After the collapse of the Soviet Union, the third, modern period of high-rise construction started in the territory of the Russian Federation [9]. To date, there is an active construction of high-rise buildings in the country, with the largest number of skyscrapers built in Moscow. We should mention the complexes of high-rise buildings such as "Bashnia Federatsii", "Edelweis", "Trikolor", business center "Sokolinaya gora", quarter "Vorobyovy Gory", residential complexes "Alye Parusa", "Continental" and others.

The highest building outside of Moscow is in Yekaterinburg - a 52-storey tower of 209 m high. Buildings over 100 m high have been also built and operate in St. Petersburg, Grozny, Samara, Volgograd, Krasnoyarsk, Sochi and Kazan. We should turn our attention to the advantages and disadvantages of living in high-rise buildings from an environmental point of view. It is known that the air on the upper levels is better, since the contaminants often accumulate in the surface layer. Disadvantages include the rarity of the air, recorded at a height above the 20-30-th floor, which to some extent can cause difficulties in breathing.

#### *Creation of artificial territories*

The concept "artificial territory" is used quite often, and, as a rule, is understood to be the land created in water bodies by reclamation or dumping of ground or using other technologies.

Reclamation (filling) processes of land are widely used all over the world, especially in case of a dense construction, geographical restrictions and the lack of other possibilities to build new facilities.

The Netherlands can be a striking example of artificial territories, where almost 40% of the territory is made up of filling areas. The world's largest reclamation areas are now created in the UAE under the Palm island project - these are Palm Jumeira Islands (25 km<sup>2</sup>), Palm Jebel Ali (37 km<sup>2</sup>), and Palm Deira (72 km<sup>2</sup>). The islands will be host to a large number of residential, leisure and entertainment facilities.

An example of the creation of artificial territories in Russia is the project "Morskoi Fasad" (St. Petersburg), which will increase the area of the city by 476.7 hectares. According to the project "Kazan City", new land will appear in the center of the city. Thus, by 2020, it is planned to create three peninsulas on the right bank of the river Kazanka, thereby increasing the area of Kazan by 388 hectares. In the implementation of land reclamation one should consider the negative impact on the various environmental components. For example, reclamation causes changes in the natural hydrological and hydrobiological regimes, and transforms flora and fauna of both water bodies and coastal zone.

#### *Underground construction*

In recent years, city developers have increasingly turned to the search for new effective layout solutions, taking into account the "third dimension", i.e., the vertical component of the spatial development, which, to some extent, solves the problem of the expansion of urban space and the preservation of natural habitats. One of the directions of such vertical development is the development of urban underground space. It should be understood that the construction and subsequent operation of underground facilities require substantial economic costs, however, this method of development of urban space is the most optimal and appropriate in some cases, and ensures stable functioning of the urban system [11].

Use of urban underground space involves three major problems: technical, legal, and psychological. Technical problem includes difficulties with the arrangement of the water drainage, sewerage, and ventilation. The legal problem arises from the fact that the ownership of land in the Russian Federation does not include the ownership of the underground space. The psychological problem lies in a subjective opinion of people that the underground environment is behind the same parameters of the above-ground environment in their characteristics [12].

It is feasible to accommodate tunnels, transit highways, pedestrian crossings, road junctions, garages, parking lots, social and cultural, commercial, and administrative-and-office facilities, transformer stations and other engineering

structures under ground. Among the variety of underground structures of the modern city, a special importance is given to transport infrastructure. In this regard, we should note the Soviet and Russian experience in building the metro: metro currently operates in seven million-cities (Moscow, St. Petersburg, Nizhny Novgorod, Novosibirsk, Samara, Yekaterinburg, and Kazan) [13, 14]. Thus, a diverse use of underground space helps to prevent an uncontrolled expansion of the city boundaries, and, moreover, contributes to the solution of the transport, urban planning, engineering, and environmental problems.

#### **4. Summary**

To summarize, it should be noted that the problem of the territorial deficit in the process of urban development is quite relevant. The shortage of land within the city limits can be overcome by extending the boundaries, as well as using more comprehensively both the internal and external potential of the city. To achieve the best effect, it would be appropriate to use the combinations of various approaches in the urban planning practice.

#### **5. Conclusion**

Analysis and generalization of world and Russian experience in urban planning policy in solving the problem of the exhaustion of areas within the city limits has shown that overcoming the territorial deficit in cities may be solved by increasing the area of the city, urban densification, demolition of buildings and structures, by transferring industrial enterprises outside the city margin, high-rise construction, by creating filled (reclamation) areas, and underground construction. The existing approaches to the problem of land shortage within the urban area have both advantages and disadvantages, including environmental ones.

To achieve the best effect, it would be appropriate to use the combinations of various approaches in the urban planning practice.

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