Principles of organizing new residential development in the peripheral areas of the single-industry towns of the middle Volga

Camilla Shaimardanova[^1] and Evgeny Prokofiev[^1]

1Kazan State University of Architecture and Engineering, Kazan, Russia
E-mail: shaimardanova@gmail.com

Abstract. The article discusses current problems and trends in the residential development in the peripheral territories of single-industry towns in Russia. Based on international research, a comparative analysis of the periphery state of cities in Europe, the United States and Asia is presented. An architectural and urban planning analysis of the territories of five single-industry towns in the middle Volga region of the Russian Federation was carried out in order to identify territories suitable for the organization of a residential environment. Based on the research carried out, the principles of organizing the spatial environment of the peripheral zones of single-industry towns in Russia are defined and formulated. The proposed methods of forming architectural and urban planning space can form the basis of urban planning activities at the stage of development of master plans, as well as become the basis for the formation of a new comfortable living environment.

Keywords: peripheral areas, residential development, residential architecture, single-industry towns, urban development, urbanization.

1 Introduction

The emergence and development of Russian single-industry towns falls at the initial period of the formation of the Soviet state and accelerated industrialization. Every five-year period 100-125 new cities emerged in the country. A large part of them was located in areas of natural resource development, construction of hydro - and thermal power plants, and hydrotechnical facilities. For the period of 1926-1967 the urban population of the USSR increased from 26.3 million to 130.0 million people. The population of new cities numbered almost 35 million people. In a later period, the importance of this type of city-forming became the impetus for the development of large industrial centers (Tolyatti, the City of Chelny, Zavolgie).

At the beginning of the property redistribution period in the 1990s, the amount of single-industry towns was about 40% of all cities in the country, 23% of which was the urban population. As a result, 12% of the country's urban population lived in 14% of Russian cities was involved in big business.

The placement of the residential zone near the production was conditioned by the need to provide housing for the company's employees. Each new factory, repair shop, power plant, transport hub, erected or expanding, acted as an occasion for the expansion of the existing settlement or construction of a new one, often from scratch. At the same time, a minimum set of public buildings was organized, which at the moment does not correspond to the needs of society.

Today the mentioned stage of urban development, chaotic and uneven development of the periphery led to a change in the functional zoning of cities, the formation of closed production areas, the detachment of public and residential areas of a city. On the peripheries of single-industry towns
there is lack of: transport accessibility and infrastructure, organized residential development, satiety of public, social facilities, places of leisure, and places of application of labor.

Generally, demographic statistics indicates an outflow of people to central regions. Most of the population of single-industry towns today is elderly people, former employees of enterprises and industries. At the time of the construction of the city and the development of production established dwelling, does not meet the modern requirements of architecture, urban planning, qualities and norms of the modern urban environment. At the present stage due to the reduction in production, urban enterprises are not the key objects for providing jobs; the younger generation is forced to leave small towns due to the lack of jobs, dwelling, and infrastructure.

Cities with a shrinking population, with one plant on the outskirts, to which residents go half an hour by bus, must solve a number of tasks. The most important of them are the motivation of people not to go to large cities and attract new people from outside, ensuring incomes of the city at the expense of the existing businesses.

The situation is similar to the one in other countries. But the process of the emergence and development of foreign single-industry towns is in many ways different from the situation in Russia. Particularly acute, the problem of single-industry towns in the United States escalated in the seventies of the last century [1], [2]. The industrial boom, especially in the steel and automotive industries, has led to the decline and collapse of American companies, unable to withstand the onslaught of overseas competitors even at home, not to mention international markets [3]. As a result, cities, whose populations were mainly occupied by one company that could not withstand global competition, were affected. Territories influenced by the sharp decline in industrial production have been dubbed the Rust Belt in the United States [4], [5].

In the 1930s, the village of Nickel having the name of the element in the Mendeleev’s table began construction in Finland. The housing was built around the plant of the Finnish company Petsamon Nikkely. Later, the city was part of the Soviet Union and, although, during the Second World War, the production capacity of the plant was almost destroyed, the plant was fully restored and in 1946 the first smelting plant took place.

In 1959, Nickel had a population of 16,305. In 1970 it reached 21,299 people. The city peaked at the end of the eighties. Since then the number of residents has steadily fallen, in the city of 15 square kilometers area live 11,599 people.

In urban-type community Nickel there are one and a half hundred one-storey to nine-storey houses [6].

The experience of European countries reveals the tendency to develop the periphery of the city by building their private houses, low-rise housing complexes [7]. Areas are filled with new features; [8], [9], [10]. The new planning structure allows accommodating all necessary social infrastructures, new residential areas. The development of the infrastructure of these places allows improving the economic condition of the city [11], [12], [13]. The expansion of the residential area implies the offering of new concepts for urban life, focused on the specific requirements of residents [14], [15], [16], [17].

However, studies in Chinese cities are rare [18]. Little attention is paid to the formation of accessibility, variations among population groups, as well as the impact of land use and transport infrastructure in Chinese cities [19].

The type of development of the periphery of Asian cities is not much different from the construction of the center. There is no tendency to lower number of storeys, preservation of natural landscapes, and improvement of ecological condition [20].

The problems of mass construction in the Soviet period occurred in 1950-1980. Due to the need in building a large number of housing, architectural and artistic solutions are overshadowed. The functionality of residential sections, the speed of their implementation and commissioning become a priority in the design. The consequences of these decisions are leafless, gray urban environment, lack of architectural and artistic and volume-spatial expressive forms, and loss of uniqueness of the city.

2 Materials and methods
The current state and functional satiation of the peripheral zones of single-industry towns in Russia is
filled with low quality housing. As a result lack of infrastructure, places of leisure, educational institutions, and social facilities are observed.

Five monocities of the middle Volga region were selected for urban planning analysis: Naberezhnye Chelny, Almetyevsk, Tolyatti, Yelabuga, Nizhnekamsk.

The developed method of analysis of the peripheral areas of the city includes the following aspects:

- Existing and approved city master plan;
- Transport scheme;
- Greening scheme;
- The scheme for placing places of employment application;
- A diagram of the current state of development;
- The scheme of zones with special conditions of use;
- How to place power lines;
- Exploring the city's climatic features;
- Exploring the modern functional state of the peripheral areas of single-industry towns.

3 Results

The results of the study were the peripheral areas free of development and suitable for the organization of a residential environment on them. On the basis of the results, three principles of the organization of architectural and urban space are proposed:

1. The principle of dependence and independence of territorial infrastructure;
2. The principle of the remoteness of the territory;
3. The principle of identity.

Depending on the remoteness of the territories from the urban infrastructure, certain lists of necessary requirements for the organization of construction are formed:

1. Providing transport infrastructure;
2. Providing engineering infrastructure. The presence of main line networks (electricity and heating, water supply, drainage) reduces the cost of construction. In industrial or communal-warehouse areas, the building capacity of engineering infrastructure corresponds to or exceeds the standards required for the development of residential and multifunctional development;
3. The presence of public and business infrastructure in the surrounding areas. Residents of a new building can start using such facilities as soon as they settle. Proximity to labour applications, trade, services, leisure and recreation, education and health allows residents of buildings located in the reorganization territories to spend less time on daily movements. As a result, the overall burden on the city's road network and the risk of traffic congestion are reduced;
4. The preservation of natural and agricultural areas in the city limits.
5. The proportionality of the human environment - in order to create more chamber and safe public and collective spaces, it is necessary to limit the floor and to abandon the compaction of the building;
6. The versatility – for a new type of building a combination of different functions within neighborhoods and buildings is important. This improves the availability of urban services, the development of the local economy, including job creation, reduces car dependence and supports local communities. Creating these spaces will avoid the monotony of the environment.

To form a quality living environment in the peripheral areas, three models of development are proposed:
1 model: high-rise building, point building – placement in a radius of 500-1000 m;
2 model: medium-storey building, accommodation in a radius of 1000-2000 m;
3 model: low-rise, accommodation in a radius of 2000-5000 m.

4 Discussions

The main aspects of the new urban environment organization are the search for the identity of the city and its application in objects and facilities. Urban identity as a set of urban meanings ensures the residents’ identification through identification of the city by significant person symbolic means (images, concepts, codes, etc.). Urban identity is formed by establishing a symbolic connection
between the individual and the city. It is dynamic and changes under the influence of the process of designing urban meanings.

The 1st model of development is small residential complexes or residential buildings of compacted building, located in the nearest access to urban infrastructure. Thus, it is a dependent model of the organization of the living environment. At the same time, social infrastructure facilities can be located on the territory, in situations where they are not available within the pedestrian accessibility radius – 500 m.

The 2nd model of the development is represented by organized residential areas of the middle floor. With their own medical institutions, shopping malls, educational institutions. This model is independent of urban infrastructure, with its own infrastructure. In addition to the development of public spaces and the socialization of the population, the presence of new facilities can contribute to the organization of new jobs. At the same time, the location in the radius of 1000-2000 m does not exclude the problem of pendulum migration and the complete abandonment of a personal car by residents. Thus, it may be necessary to organize a transport hub [23].

The 3rd model of development is represented by residential areas and individual residential buildings. Such residential zones are within a 2,000-5000m radius of the city and have their own infrastructure.

The results reveal trends in the development of peripheral zones of single-industry towns of the middle Volga region of Russia. Trends of the formation and organization of residential zones, which contribute to the creation of a comfortable environment, ensure the mobility of the population and raise the standard of living in general and outlines single-industry Russia’s middle Volga region towns. They form a unique, comfortable urban environment, improve its quality and comfort.

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