Methods of Reconstruction of Park Territories on Condition of Ecosystem Conservation

T G Artemyeva¹, E M Balzannikova², M I Balzannikov³

¹Samara State Technical University, Academy of Architecture and Civil Engineering, 194, Molodogvardeyskaya St., Samara, 443001, Russia
²Samara State Technical University, Academy of Architecture and Civil Engineering, 194, Molodogvardeyskaya St., Samara, 443001, Russia
³Samara state University of Economics, 141, Sovetskoj Armii St., Samara, 443090, Russia

E-mail: tatart2@gmail.com, balzannikova@mail.ru, mibsgasu@mail.ru

Abstract. The article discusses the process of the urban framework transformation that occurs as a result of the development of urban tissue. The authors analyzed the most common changes in the state of urban park territories, as well as approaches for their further use. The need for structuring the functional areas of park territories taking into account the existing environmental situation is singled out. Two main city park subsystems are identified: ecosystem and recreational environment. The principles of their interaction are revealed. The forms of degradation and destruction of the ecosystem of park territories depending on the factors of aggressive influence are indicated. The authors analyzed the typical functional composition of the park recreational environment. The main characteristics and anthological problems of urban park areas are identified on the example of the author’s concept for reconstruction of the Gorky Park located in Samara city. The universal method of preserving the ecosystem in an urban park environment is proposed, which is based on the principle of segregation of zones and concentration of functional consumer facilities.

1. Introduction

Most cities permanently create conditions for the development of functional zones on the principle of either blocking and/or merging, or their segregation. This is due to the process of continuous growth of urban tissue, which necessitates its structuring and leads to the transformation of the urban framework [1]. The territories of functional zones during the growth of urban tissue change their quality and position (location) from peripheral to peripheral-central or central. This process is accompanied by a complex of changes the inevitability and necessity of which should be taken into account when forming the concept of reconstruction of such territories [2]. In addition, it is necessary to take into account the existing environmental situation and the presence of possible objects or elements of cultural heritage [3-6].

Thus, the actual approach to research, substantiating decisions on the reconstruction of urban park territories, is to analyze the historical transformations of the existing functional zones and take into account their environmental and cultural components.
2. Analysis of Park areas
The authors analyzed the most common changes in the state of urban park territories, as well as approaches for their further use. Studies revealed that forest and park territories, which origin and formation on the outskirts of the city was a stage of the natural urban development, eventually become functional zones involved in the city structure. Important characteristics of such territories include their significant size and potential for further development, which subsequently undergo significant transformations. The inevitable extension of the functions of park territories, in the process of their development, results in qualitative changes in their features [7, 8].

At the same time, it is necessary to take into account the possible emergence of the cultural and historical value of the territory under consideration as an integral element of the existing urban environment, as well as to determine the object of its protection [9, 10].

Park territories of the English landscape type are formed on the basis of two most important components. These are the ecosystem, in this context – the established stable interrelations of flora and fauna over a long period of time on a specific limited territory, mainly wild plants and undomesticated representatives of the animal world, and the artificial environment – a system of recreational facilities and related infrastructures. Both components have independent character, however, their interaction as parts of a single park unit is characterized by specific features. Namely, recreational environment tends to expand, develop and consolidate its components, thereby increasing the aggressive impact on the ecosystem; as a result of the development of the recreational environment, the ecosystem is degrading in the vast majority of cases. Ecosystem degradation can take different forms: from the gradual succession to the complete disappearance of its original state [11-13].

Separately, we should consider the role of park territories with the existing ecosystem in the composition of metropolises. Studies indicate a positive effect of the contact of residents of highly urbanized territories with wildlife on their stress resistance and the need to preserve wildlife fragments in urban tissue as much as possible [8-13]. Moreover, the contacts of people with wildlife do not equate to similar contacts with cultural landscapes or domestic animals (in terms of impact). In addition, ecosystems of parks, as objects with a long history of formation, represent an objective social reality associated with the “memory of the place”. Christopher Alexander in his book Template Language [14, pp. 170-171] indicates that “… it is absolutely necessary to preserve these places and not diminish their significance. The destruction of places that in a broad and generally accepted sense have become part of public consciousness will inevitably lead to the appearance of open wounds on the body of the society”. In other words, according to the authors, the nature of the interaction of the ecosystem and the recreational environment should be carefully studied with the identification of the factors that provoke the degradation of the ecosystem of the park areas. Methods of neutralizing these factors and minimizing the negative impact of the recreational environment on the ecosystem should also be considered.

The authors analyzed the typical functional composition of the park recreational environment. It includes, first of all, beautification system, including walkways, bike paths, sites that divide the park into fragments separated from each other by asphalt or other types of paving with borders, as well as entertainment and leisure facilities, attractions that attract large groups of people that have a negative audio-visual impact on the fauna of the ecosystem. In addition, it includes objects of mass sports and spectacles that attract people and lead to trampling of grass, catering and trade facilities. The functioning of the latter as part of the recreational environment of the park requires active transporting of goods and products, as well as the maintenance of sanitary and hygienic zones and export of solid waste.

The functioning of the above-mentioned elements of the recreational environment of park territories changes the environmental parameters, including the composition of air, which also leads to deterioration of the video and audio characteristics of the ecosystem and its further degradation.

In addition to the designated objects that make up the recreational environment of the park, a particular problem is caused by objects whose appearance on the territory of the park became possible as a result of changes in the socio-economic status of the state. Such foreign objects include summer
cottages, residential houses, outbuildings that are not related to historically developed park territories, and are not related to the park’s original recreational environment. The activity of such foreign objects has the most direct negative impact on the ecosystem of the park.

Thus, any object whose location and functioning leads to a depression of the ecosystem and, as a result, to devaluation of the park as an element of the cultural and historical potential of the city can be attributed to ecosystem destruction factors.

The ecosystem as part of the existing park areas and in the context of the urban environment is of cultural and historical value to the society. The reconstruction of each specific park requires an individual approach when choosing reconstruction measures that neutralize the factors leading to ecosystem degradation. Despite the individuality of approaches, ecosystem conservation factors have a common basis: maximum concentration and distribution of recreational facilities; maximum distance of the recreational environment from the ecosystem; consideration of the legitimacy of placing “non-systemic” objects in the park in terms of their compliance with urban regulations. Generally speaking, reconstruction in the context of ecosystem conservation should lead to a restructuring of the park area.

An example of measures aimed at preserving the park’s ecosystem is the author’s concept of reconstruction of the Samara Gorky Park. The park (with an area of 42.4 hectares) is a state natural monument of local importance. The ecosystem of the park is represented, among other things, by rare species of plants and diverse fauna. The Gorky Park, opened in 1932 at the place of a former merchant’s estate, has been a popular place for year-round recreation for residents and visitors of the city for more than 85 years. The untouched natural landscape of the park within the city contributes to maintaining the comfort of people and their psychological balance in the stressful environment of the metropolis.

A pre-project analysis of the territory, carried out as part of an open competition to develop a concept for the reconstruction of the Gorky Park in Samara, revealed the presence of the park’s ecosystem, formed as a fragment of natural biogeocenosis, included in urban tissue; a mix of French formal and English landscape garden; the presence of objects scattered around the park, including “non-systemic” ones; low level of development and improvement of the recreational environment; unsystematic formation of traffic on access roads to recreational facilities, including the chaotic arrangement of recreational facilities, the lack of a system for distributing flows by quantitative attributes to mass, group, individual ones and the influence of quantitative attributes on the location of recreational facilities.

At the moment, the park exists as a conditionally reserved territory, being a constant object of commercial interest under the risk of unauthorized seizure with a change in the town-planning status and territory regulations.

At the same time, there is a steady trend towards the commercialization of the park by intensifying the use of the recreational environment. The paradox is as follows: continuous improvements to the recreational environment create the conditions for attracting investments in recreational facilities and, accordingly, increase the attractiveness of the park as a resting place for people. On the other hand, these processes are active and form an excessive load on the park’s ecosystem, which ultimately leads to its degradation.

3. Concept

The solutions to problems of systemic nature, proposed by the author’s concept, are universal for park areas under reconstruction.
The basis of the proposed concept is the segregation of the park’s ecosystem and the recreational environment by concentrating the active functions of the consumer destination in a structured metabolic linear bridge-like structure, which would ensure minimal transformations of the natural landscape and preservation of the existing ecosystem, while at the same time forming a developed leisure infrastructure with the possibility of organizing cultural events with multiple scenarios on its territory (Fig. 1).

The location of the linear bridge-like object along the longitudinal axis of the park (Fig. 2) provides the minimum visual load on the perception of the panorama of the river Volga from the city bank, at the same time, the panorama of the city is enriched with a dominant focus that emphasizes the position of the geometric center of the city.

Raising the recreational environment to a vertical level different from the elevation of the earth’s surface allows preserving the continuity of the ecosystem and, at the same time, repeatedly increasing the potential availability of objects of various functions within the recreational environment.

The concept provides for the possibility of sequential addition to the bridge structure of the objects of various functions (catering establishments, attractions, spectacular objects, children’s climbing walls, recreational facilities of a group and individual nature, viewing platforms, etc.), including the possibility of adding the facilities during the phased implementation of the project.
The concept proposes the transfer of facilities located in areas privately owned (catering, attractions, small trade, etc.) to the main bridge structure, taking into account the compliance with the compensatory conditions (when implementing public-private partnership agreements), and arrangement on the vacant areas that become state property of facilities compatible with the ecosystem of the park (barbecue areas, areas for children and quiet recreation, small reservoirs of bifunctional use (splash pools in summer, small skating rinks in winter) and so on).

Moreover, the rearrangement of the landscape by freeing the park from entertainment facilities, established in recent decades in the park, leads to the restoration of the original structure of the park.

The authors propose to combine large technically complex attractions such as the Ferris wheel and roller coasters with the bridge structure, arranging traffic walkways to the attractions from all levels of the bridge.

The concept also provides for the organization of a sanitary service network using biotechnologies. A boiler supply of water from an artesian well to consumption points is organized. In addition, the authors propose to organize heating of park facilities using electrical equipment.

An important component of the engineering infrastructure of the park is the use of alternative (renewable) energy sources. The territory of the park adjacent to the riverbank allows the use of air flows from the river towards the city for energy purposes. To do this, the authors propose placing two small wind turbines on the frontal planes of the extreme supporting elements of the bridge under the consoles facing the Volga bank (one under the straight part of the bridge, the second under the diagonal part) in compliance with regulatory requirements (the distance between the wind turbines is equal to six unit diameters).

In addition, the authors propose to place solar panels on the upper structural elements of the bridge. Inside the bridge structure, they propose to provide for the possibility of organizing local fitness centers with placement of rotary-type gym equipment for running and walking (“squirrel wheel” type) with the function of generating electricity by users and its subsequent transmission to storage batteries.

The construction of the bridge is also considered as a carrier of transport communications. The authors propose to include a monorail in the structure of the longitudinal axis of the bridge with a suspension on the lower boom of the bridge supporting structure for transferring people, including citizens with low mobility.

The passage of specialized vehicles (cleaning and fire fighting) is provided along the hard roads with landscaping (eco-grid) organized on the territory of the park.

Thus, the concept sets a new modern level of development of the territory of the city park, providing for developed vertical landscaping with minimal negative impact on the ecosystem.

4. Conclusion
1. In the process of urban tissue growth, urban park territories are changing their position from peripheral to peripheral-central or central. Such a transformation must be taken into account when developing the concept of reconstruction and improving the necessary functionality of the park.

2. The growth of the functional components of the recreational environment on park territories leads to increasing aggressive effects on the ecosystem, as a result of which the latter inevitably degrades.

3. In order to reduce the negative impact on the ecosystem of urban park areas requiring reconstruction measures, the principle of segregation of zones and concentration of functional consumer facilities is proposed. A metabolic linear bridge-like structure that forms a developed leisure infrastructure with the possibility of organizing cultural events with different scenarios on its territory can serve as the main resource for the implementation of these principles.

4. Raising the recreational environment to a vertical level different from the elevation of the earth’s surface, proposed by the authors, allows preserving the continuity of the ecosystem and repeatedly increasing the potential availability of objects within the recreational environment. This approach to organizing the recreational environment of park territories is a universal method of preserving the ecosystem in urban environments.
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