

# "Green architecture" as an Onnovative Direction of Construction

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**Abstract.** The attention is focused on the necessity of formation and development of "green architecture" in the urbanized urban environment by constructing buildings with integrated landscaping in the three-dimensional structure. This is a new direction in modern architecture in the world due to urgent need of fitomelioration of the urban architectural environment of living of the masses of the urban population, is caused by a significant deterioration of the environmental quality of the urban environment in cities and major settlements, actively and comprehensively counter which is capable of vegetation. Its inclusion in the space-planning structure of objects is a way of integration of architecture and nature, which restores the disturbed symbiosis of man with his environment. This contributes not only to the optimization of the ecological quality of living spaces of settlements, but also To the stability of the urban environment in the process of its transformation and development.

## 1. Introduction

Urban environment of a large modern city, to the limit is full of buildings, structures and vehicles. Its ecological problem is now assessed as "high" and "very high". Components of "urbolandscape" (air, water, soil, vegetation) perceive and accumulate such amount of harmful and toxic substances that reserves of its self-purification are almost exhausted. This means that the conditions of the human environment approach the threshold of tolerance, beyond which they should be considered critical.

Man-made loads of functioning urban systems and, above all, vehicles are so intense that the quality of the environment of the outer urban space becomes environmentally aggressive. This is especially noted in the zones of historical centers of cities, where the planning structure is not adapted to the modern level of development of motorization, as well as in actively urbanized human-intensive areas, to the limit saturated with various functions and material components-roads, buildings, infrastructure, industrial facilities, etc.

There is a whole system of alternative measures to improve the quality of the urban environment and it should be recognized that not enough has been done. But all of them are not yet able to significantly resist the powerful pressure of road transport systems, because of which, in General, the urban environment is increasingly becoming an aggressive environmental space, in which every living organism is becoming increasingly difficult to survive-a powerful gas contamination, dust and chemical contamination of the environment has become, in practice, the "NORM". Such cities, unfortunately, are now among many large and largest cities, including Moscow. This is especially noted in places saturated with transport routes.



In this environment, almost all living components of the environment, including humans, are intensively degraded, and the only natural and ecological alternative-vegetation, "steadily" disappears. It is known that motor transport leads to pollution of the environment by formaldehyde, oxides of nitrogen, carbon monoxide, benzopyrene, lead and products of their chemical transformations. Industry and power plants emit sulfur dioxide and hydrogen sulfide etc. Pollution is chemically aggressive dust is very high. To this should be added the negatives of salt and deicing reagents. They are deposited in the soil, creating an environmentally friendly environment for plants. Vysokoprochnost and number of storeys of the building dramatically reduces the illumination of the urban space. Buildings and structures violate the natural structure of the earth, water balance, ventilation. Around the trees, vortex and stagnant zones are created, concentrating pollution in the zones of root systems. The problem of soil dehydration is particularly acute in cities. Almost all water consumed for watering of streets and needs of the city goes to the Sewerage, and therefore, is lost for plants. Accordingly, there is a decrease in groundwater level and drying of the soil layer. As a result, the upper fertile layer is compacted and transformed into a crust, particularly affected vegetation near sidewalks, buildings and structures, as the area of root soil rarely corresponds to the parameters of the root system. Because of this, the former is beautiful "green dress" Tverskaya (formerly Gorky street) disappeared completely. Several years ago in medicine recorded the occurrence of special diseases called "syndrome of the Garden ring" that affects the population of the territories near trunk road, especially the children. Modern urban environment is - "hard concrete landscape" of high-density multi-storey buildings, almost leaving no areas for landscaping [1, 2]. And since the trend of consolidation of urban development continues, the achievement of its normative volume and biological status is very problematic. Already now in the city center the remains of former gardening live out the century, and new here simply isn't formed owing to environmentally adverse conditions.

Ecological symbiosis of man and plants was formed by evolution for centuries and therefore is indisputable. However, the modern rhythm of life and its functional organization cut thin interrelations of citizens with vegetation [3]. Thus, their symbiosis is disrupted, which has a very negative impact on people's health.

Realizing the necessity of biocontact with the natural environment, the citizen tries to compensate its absence in one way or another [4]. The most common is the greening of living and working spaces with "indoor" types of vegetation, since leisure recreation in the "natural landscape" of the city is less often available in time, suburban - episodic, and recreation in nature - vacation, is only 3.3% (two weeks) to 7.5% (28 working days) in the total budget of the annual time.

Only a small part of the population of the metropolis economically and functionally can afford to live in suburban "green zones", but they spend most of their time in the city. The vital activity of the population proceeds in ecologically negative conditions-the urban environment. In this regard, at almost complete absence of contact with the pure nature and greens, the citizen has no real opportunity to use natural bioresources of vegetation, providing activity of the organism through ecological systems of the nature [5]. Thus, we can assume that almost the entire population of megacities is experiencing the environmental negatives of the urban environment and the organization of its space.

Realizing that plants play a huge biological role in the human environment, it is necessary not only to feel and realize it, but also to take effective steps for the development of the landscaping system.

## 2. Discussion

One of the directions is connected with professional search of ways of forming of vegetable components in the nearest environment of life and activity of the person – in space of buildings. In this regard, the construction of "green buildings", in the system of which structurally and purposefully designed spaces for plants - greenhouses, greenhouses, terraces, winter and summer gardens, green balconies and loggias, as well as formed stylobate-platform open and protected gardens on the surface of operated flat surfaces of buildings and structures [6], should be considered to be fully justified and environmentally sound. This direction has a fairly large environmental capacity, which can be successfully implemented in buildings and constructions of various purpose.



**Figure 1.** Editt Tower, Singapore.



**Figure 2.** Solaris, Singapore.

Landscape architecture makes a lot of effort to harmonize the environment by greening urban areas. But the external "decoration" and even a significant increase in the external green fund of the city today can no longer fully compensate for the "vegetable" needs of the urban guard [7]. It needs biologically closer contact with the living plant, which, unfortunately, is increasingly lost. In many ways it is the problem of architecture, which arose relatively recently, and therefore insufficiently disclosed.

An effective aspect of the formation of "green" spaces in buildings located in difficult environmental conditions should be considered stabilization of living conditions and plant development [8]. This involves not only the formation of special compositionally and functionally organized spaces - the sphere of architecture, but also the optimization of the physical parameters of their environment Design structure, equipment and equipment - engineering and technical aspects. Not all plants can exist in the climatized space of buildings without "support" [9].

We are on the threshold of the postindustrial era and the stage of the environment suburbanization. This means that we should expect an increase in urbanization processes. Consequently, it is inevitable that the artificial components of the urban environment should be transformed, the leading principle of optimization of which will be the greening of the environment, in which the unity of the place of man and vegetation will become, apparently, the leading principle of the biopositive formation of space.

About ten years ago, integrated "Program-21" international environmental forum was the principle of "eroticomaniacal" environment, which opened a new era in architecture. Greening the building fully corresponds to it, which makes it an relevant, despite the apparent superficial palliative. Thus, this direction, in contrast to the traditional one, is oriented towards the future.

### 3. Insights

A major Russian architect-scientist M. G. Barkhin, talking about the ways of development of progress in architecture, in the book "Architecture and the city" wrote: "we are talking about the problem of urban planning of the future in General, Our position involves the most mandatory and urgent need as a prayer to think more and more forward, to think aggressively and scientifically sound. But not in order to oblige it to work tomorrow, but to know how to do today."

In this regard, it seems that the greening of buildings is an effective direction in architecture and a progressive way to find means of ecological optimization of the space of the urban environment at the stage of its further development.

Today, architectural practice is seen as an integral component of the urban environment, forming a system of "green buildings" in the structure of the city. One of the first examples of ecological settlements was Lanzhou district, China (fig. 3-4).



**Figure 3.** The concept of a "green" city Forest City Liuzhou, Lanzhou, China.

Author: Stefano Boeri.



**Figure 4.** "Green" architecture, Lanzhou, China.

Author: Stefano Boeri.

In Lanzhou district began construction of the city for 30 thousand inhabitants, the author of which was Stefano Boeri. The project called Liuzhou Forest city, involves planting plants on each building. Its main concept is the need to save China from an environmental disaster caused by the development of the economy and production. It is assumed that the plants will process about 10 thousand tons of CO<sub>2</sub> and 57 tons of other pollutants and at the same time, saturate the environment with oxygen. The construction of the city is planned to be completed by 2020. This project can be considered a pilot project, because today it has no analogues of its scale.

Stefano Boeri in an interview noted that the construction of "green" facilities on such a scale is of great social importance. It is of great importance for improving the quality characteristics of the environment.

Prognostic is a futuristic project of the reconstruction of Paris (France) ecological orientation, the main idea of which was the inclusion in the current IP-toric building (fig. 5-6). The concept was developed by the Studio of architect Vincent Callebaut. The aim of the project is to reduce greenhouse gas emissions, which is fully consistent with the concept. According to the project, new buildings should be inscribed in the existing urban environment, not breaking it, but only complementing. However, the project does not have a well-developed technical concept, which means that it is practically impossible. This proves once again the need for comprehensive research in this area.



**Figure 5.** Conceptual development of the reconstruction project in Paris The 2050 Paris Smart City. Vincent Callebaut Architectures architectural Studio.



**Figure 6.** "Green" building. The 2050 Paris Smart City. Vincent Callebaut Architectures architectural Studio.

Another equally important project of Vincent Callebaut's Studio was the project of the eco-district in Rome (Italy), fig. 7-8. The project has an environmental focus and demonstrates the trends in the

development of the architecture of the SAR as a town-planning education, in the transition to a higher level of elaboration of decisions.



**Figure 7.** Conceptual design of the building project of the eco-district of Rome Citta della Scienza. Vincent Callebaut Architectures architectural Studio.



**Figure 8.** Example of a "green" building for the eco-district of Rome Citta della Scienza. Vincent Callebaut Architectures architectural Studio.

The trend has a conceptual focus on improving the environmental quality of urban education in General and their elements in particular.

## References

- [1] Koshkina S Yu, Korchagina O A, Voronkova E S 2013 *"Green" construction as the main factor in improving the quality of the environment and human health* (Issues of modern science and practice. University them. V I Vernadsky) vol 3(47) pp 150-158
- [2] Sergienko L I and Podkolzin M M 2010 *Green construction as an element of sustainable development of Russia* (Ecology of urban areas) vol 1 pp 18-23
- [3] Nemcev I A 2014 *Green construction: eco-settlements as part of the concept of sustainable development* (Urban studies) vol 3 pp 8-25
- [4] Kildisheva S V 2006 *Modern methods of urban gardening. Vertical and roof greening* (Ecology of urban areas) International scientific and practical conference (Moscow) pp 37-38
- [5] Pereladov A A and Plishkin V A 2003 *The Importance of the ecological approach in the architectural activities of the new Millennium* (Architectural science and education. Proceedings of the Moscow Institute of architecture (state Academy)) vol 1 pp 238 – 243
- [6] Usov Ya Yu 2010 *Green spaces in bioclimatic buildings* (Science, education and experimental design in MARKHI) Abstracts of scientific-practical conference (Moscow: Architecture-C) pp 127-128
- [7] Sagalaev V A 2014 *Eco-friendly era in architecture* (Construction, design, architecture: design decisions of the nineteenth century) Collection of materials of the international scientific e-Symposium. Edited by I. K. Danilov (Kirov: international center for research projects) pp 96-104
- [8] Leksikova V V 2017 *The plant as a component of green building* (Environment and agriculture) Proceedings of the conference (Orel) pp 83-89
- [9] Tsitsilin A N 2006 *The main problems of indoor use of plants and their solutions* (Ecology of urban areas) International scientific and practical conference (Moscow) pp 82-85