Development of Methodic Approach to Selection a System for Yards and Spaces between Constructions Landscaping

E Lysova¹, O Paramonova², N Yudina³

¹Department of Environmental Engineering, Don State Technical University, 344022, Sotsialisticheskaya str. 162, Rostov-on-Don, Russian Federation

E-mail: ¹ katerina.lysova0803@gmail.com, ² paramonova_oh@mail.ru, ³ udi-natasha@yandex.ru

Abstract. Formation of a modern comfortable environment in Russian cities has become one of the priority tasks of the state scale. Development of fundamentally new approaches to the organization of integrated landscaping of courtyards and inter-building spaces according to the principles of comfort and bio-positivity will improve the quality of life of the country’s urban population. However, there are a number of organizational and informational problems associated with the interaction of territorial bodies of state and municipal administration, the interests of the population and organizations performing these types of work. The paper proposes a methodology for choosing elements of the improvement of the territory of courtyards and inter-building spaces both for the existing development and for newly built territories, based on taking into account the optimal ratio of the parameters of a comfortable environment, taking into account the peculiarities of the urban planning situation, utilities, the morphotype of the building, the type of yard, its configuration squares.

1. Introduction

In the Russian Federation the quality of the urban environment directly depends on the amount of funds allocated for the improvement from regional and local budgets, as well as on the systematic work of territorial authorities to develop a complex of landscaping and create a comfortable urban environment of a qualitatively new level [1-5]. The following types of territories are subject to landscaping (figure 1). To date, programs for the formation of a modern urban environment are being implemented within the framework of the priority project «Formation of a comfortable urban environment» for 2018-2022 [6] and are developed at the local government level with the active participation of the population. At the same time, the territories of courtyards and inter-building spaces are subject to priority improvement. It should be noted that the ongoing projects for the improvement of the territory of courtyards and inter-building spaces on the territory of the Russian Federation include a minimum list of works financed from the federal budget: repair of yard driveways, provision of lighting of the territory, installation of benches, of rubbish bins [6].

Supplementary list includes the following works: equipment for playgrounds and sports grounds, equipment of car parks, landscaping of the territory, installation of small architectural forms [6]. These types of work can be performed only with the direct participation of owners, commercial and public structures. When landscaping the courtyard, the principles of barrier-free access for people with limited mobility must be taken into account [6].
Constitution of the Russian Federation guarantees every citizen the right to a healthy environment. In the everyday life of every person, this right can be realized through the improvement of the territory of courtyards and inter-building spaces of cities.

A modern city is simultaneously developing along several trajectories - the construction of new residential neighborhoods and infill development. Analysis of foreign and domestic experience shows that in order to form a biopositive urban environment, it is necessary to focus on environmental elements when implementing projects for the improvement of small common areas in courtyards and inter-building spaces. First, the area of the courtyard space is multifunctional and makes up a significant share in the total area of the city. Secondly, the aesthetic component of the improvement of the territory of courtyards and inter-building spaces creates the uniqueness of the city's micro-districts, and the greening of these territories contributes to the core of the city's «green frame» [7]. Thirdly, the improvement of any territory is designed to compensate for the negative consequences of urbanization - increased dustiness and gas-polluted air, lack of light, isolation from nature, increased noise levels, etc. [8-10].

The topic of the improvement of urban areas is widely studied, many domestic and foreign scientists are engaged in it – Belousov V.N., Biryukov L.E., Borusso Zh., Velikhov L.A., Howard E., Zalesskaya L.S., Kvasov A. F., Le Corbusier, Luntz L.B., Mikulina E.M., Murgante B., Mukhitov R.K., Otto K., Palentreer S.N., Puchenkov O.V., Sytin P.V., Fazleev M.Sh., Frenkel Z.Kh., Khromov Yu.B., Chistyakova S.B., Yankovski P., Yarchina Z.N. and others. The analysis of the publications made it possible to identify a number of problems common to the territories of courtyards and inter-building spaces of the overwhelming majority of cities in the Russian Federation, regardless of the size of the living population:

1) lack of financial support for the reconstruction of the territories of the courtyards and inter-building spaces of the main housing stock;
2) absence or poor organization of adjacent parking spaces, which creates acoustic discomfort and pollution of atmospheric air by exhaust gases;
3) a low level of accessibility of the environment for people with limited mobility (the presence of barriers and obstacles to movement - steps of stairs, sidewalk curbs);

![Figure 1. Classification of the territories of municipalities subject to improvement.](image-url)
4) non-optimal use of functional areas for their intended purpose (lack of clear visual boundaries between functional areas, non-observance of the required distance between sites for noisy and quiet recreation);
6) seasonal flooding of courtyard areas (lack of an effective drainage system for rain and melt water);
7) unsatisfactory microclimate parameters (poor ventilation of the territory or, conversely, ventilation, insufficient sunlight, etc.)
8) low level of security (primarily due to insufficient illumination);
9) irrational location of transit zones (lack of accounting for existing pedestrian flows, lack of through paths).

Thus, the problem of the improvement of courtyards and inter-building spaces is very urgent and requires the adoption of effective systemic decisions. When developing design estimates for design projects of the territory of courtyards and inter-building spaces, it is necessary to take into account the need to switch from a fragmentary to an integrated principle of the improvement of several adjacent courtyards at once, the professionalism of the developers, the quality and number of project options. All this is practically absent in most of the proposed projects for the improvement of courtyard territories, which causes fair criticism and complaints from the population.

2. Materials and methods
Successful, modern design of elements of landscaping of the territory of courtyards and inter-building spaces in residential areas of cities must comply with international standards of comfort and biopositivity of the environment. The biopositivity of the design projects of the territory can be expressed through environmental friendliness, aesthetic appeal and individuality of objects that improve the quality of life of citizens [11-13]. In our opinion, plans for programs to create a comfortable and biopositive environment should be synchronized with plans for major repairs of houses, utilities and road transport infrastructure of facilities. Carrying out large-scale improvement works should be based on an inventory and certification of all urban areas in order to clarify their functional zoning, equipment with the necessary infrastructure, and existing landscaping. All this requires the development of a unified methodology for choosing a system for the improvement of the territory of courtyards and inter-building spaces of cities.

3. Results of the study
The population associates the territories of courtyards and inter-building spaces with their home, comfort, and pleasant timespending. The main goal of the improvement is to create a comfortable, safe, accessible, aesthetic, harmonious, functional and adapted to use environment through a complex of works on the plastic organization of relief, landscaping, architectural lighting and creation of color solutions for objects, placement of small architectural forms and objects of urban design, advertising, visual communication and information, works of monumental art, etc. [14-16]. Modern composition of elements for the complex improvement of courtyards depends on a number of existing factors of the existing urban development, to which, in our opinion, the following should be attributed:

1 – Features of the urban planning situation:
- proximity (accessibility zone) or remoteness in relation to green areas of common use (squares, gardens, parks and boulevards);
- location of main streets;
- availability of inter-yard common spaces;
- territorial possibilities for expanding flat areas (children's, sports and economic grounds, recreation areas, areas for waste bins);
- the possibility of creating (expanding) parking lots, including guest ones.
- existing frame landscaping of the territory.

2 – The morphotype of development as a convenient typological unit of differentiation of the urban environment, which makes it possible to determine many significant geoeological parameters. The main building elements that must be taken into account when reconstructing territories are as follows:
• primary (number of storeys of buildings; type of buildings - serial ownership of houses; the nature of the mutual arrangement of buildings in a residential group, a quarter - ordinary, parallel, with a shift);
• secondary (building density; degree of «sealing» or overlap of the inner courtyard space).

The authors believe that the use of the criteria of the existing morphotype of the territory makes it possible to effectively adjust the improvement work by calculating the integral comfort:
a) the ratio of the sealed building and asphalt concrete pavement and free space;
b) the composition of the adjoining space and the potential for its optimization (functional zoning and landscaping);
c) pressure on the upper horizons of the lithosphere (number of storeys of houses);
d) openness and ventilation of the inner space of the quarter or residential group;
e) the degree of pressure on the environment (low, medium, high);

3 – Yard type (yard area size):
• small (area of 0.035-0.25 ha, which makes it possible to accommodate in it only a minimum set of mandatory elements that ensure the safe living of people);
• medium (area 0.25-0.80 ha);
• large (with an area of up to 1.2 ha, when their size makes it possible to form a comprehensive landscaping using all its elements);
• major (with an area of more than 1.2 ha, when their size allows to form a comprehensive landscaping of the territory using all its elements, including, if necessary, additional elements – works of monumental art, fountains, grounds for walking or training dogs, etc.)

The classification of courtyards by the size of the courtyard area allows us to take a differentiated approach to the composition of integrated landscaping, depending on the type of courtyard, as well as to develop a system of preferences in choosing elements of integrated landscaping in relation to courtyards with a shortage of areas. The deficit of the required space (more than 50-60%) prevents the saturation of the yards with all the elements of improvement (mandatory and socially necessary elements that can be placed on the territory of the yard), provided and approved by the standards.

When designing new residential neighborhoods on newly developed territories, during the reconstruction of the existing ordinary buildings, the dimensions and configuration of a comprehensively landscaped courtyard should maximally meet the functional, operational, aesthetic requirements and, along with the requirements for insolation, fire breaks between buildings, be the main criteria for planning solutions for buildings.

4 – Yard configuration (closed or open).

All of the above parameters are the initial data for the formation of a comprehensive improvement of the courtyard on the basis of a phased ranking, the maximum accounting and analysis of which allows us to develop and offer for each specific courtyard the optimal solution for integrated improvement with the maximum possible consideration of modern standard indicators of improvement. The input parameters, on which the set of measures in the complex improvement of a yard depends, are the area of the yard and the deficit of the area (if any). Depending on these parameters, the formation of elements of the complex landscaping of the yard should be carried out on the basis of a system of preferences (figure 2). At the same time, measures for the improvement of courtyards and inter-building spaces are divided into priority and additional (figure 3).

The proposed methodological approach includes the following sequential main design stages (figure 4). A methodological approach to the selection of elements of the improvement of the territory of courtyards and inter-building spaces allows to form a block of initial data both for the existing development and for newly built territories, including information on the peculiarities of the urban planning situation, the morphotype of the development, the size and configuration of the yard territory, select options for priority and, if possible, additional measures to ensure the performance of the required functions.
Figure 2. The system of preferences in the formation of elements of complex improvement of courtyards and inter-building spaces.

Figure 3. Ranking of measures for the improvement of residential areas.

Figure 4. The sequence of the implementation of the methodological approach to the choice of elements of the improvement of the territory of courtyards and inter-building spaces of cities.
In the future, this allows to choose the best improvement option based on the use of three groups of criteria to be checked [17]:

Group 1 – economic selection criteria (type and cost of building material used in the production of architectural components of the territory; technology for laying road and path surfaces; condition of roads, etc).

Group 2 – social selection criteria (social and hygienic living conditions; distance in relation to business centers, motorways; proximity to green areas, parks; slope of roads; spatial placement and configuration of architectural components of the territory, etc.)

Group 3 – environmental selection criteria (the level of air pollution; the level of noise and vibration; the level of electromagnetic radiation; the level of pollution near the located water bodies and soil pollution; organized waste collection; collection of storm water; planting green spaces; total level of environmental pollution, etc.)

4. Discussion and conclusions
The developed methodological approach to the selection of elements of the improvement of the territory of courtyards and inter-building spaces of cities makes it possible to take into account the existing situation of the territory under consideration as much as possible and to optimize the economic costs of performing work through the ranking of measures for the improvement of courtyards. It can be applied both for the existing development and for newly built areas.

5. References
[1] Eshina E V and Polyanina A Yu 2016 Education and science in the modern world. Innovations 4 pp 164-72
[2] Pechenkina A G and Valieva A R 2020 Development of regional agro-industrial complex and rural territories: Modern problems and prospects pp 375-7
[3] Voskresenskaya A I 2008 Academia. Architecture and construction 4 pp 56-8
[4] Bogaiskova A V 2019 Proc. of the 1st Nat. Conf. on the results of scientific and industrial work of teachers and students in the field of landscape architecture and forestry, ed D A Solovyov, S V Fokin et al (Saratov: Amirit) pp 29-31
[5] Gareeva G A and Rudakov A M 2018 Actual problems of state and municipal management and economy pp 13-4
[6] Passport of the priority project «Formation of a comfortable urban environment» [Electronic resource] URL: http://www.consultant.ru/document/cons_doc_LAW_216250/#dst0
[7] Yudina N, Lysova E, Paramonova O and Samarskaya N 2019 E3S Web of Conferences e3sconf(2019)03021
[8] Schweitzer F 2006 Nature 441(7095) p 815
[9] Batty M 2007 JRS 47(3) pp 624-7
[10] Davis K 2015 The City Reader pp 43-53
[11] Kazanovskaya O M and Badmaeva S E 2019 Science and Innovation – modern concepts pp 107-11
[12] Korosteleva M V and Korosteleva N V 2020 Municipal property: economics, law, management 4 pp 27-32
[13] Koroleva E N and Mishchenko V V 2020 Economics Profession Business 4 pp 61-6
[14] Sheina S G 2017 Biosphere compatibility: man, region, technologies 3(19) pp 36-43
[15] Bespalov V I, Kotlyarova E V and Bondarenko A S 2019 Scientific and methodological foundations of ensuring environmental safety of territories in the conditions of urbanization Engineering Bulletin of the Don IVDON01(2019)5553
[16] Kotlyarova E V, Smekhova L A and Kozhevnikova E M 2019 Analysis of ecological principles of development of urbanized territories Engineering Bulletin of the Don IVDON04(2019)5964
[17] Bespalov V I and Kotlyarova E V 2011 Terra Economicus 9 pp 121-3