



СӘУЛЕТ
АРХИТЕКТУРА
ARCHITECTURE

DOI 10.51885/1561-4212_2024_1_70
IRSTI 67.07

M.G. Bairakhmanova¹, A.K. Aldungarova², Monika Kulisz³

¹S. Toraighyrov university, Pavlodar, Kazakhstan

*E-mail: baidrakhmanova.mg@mail.ru**

²D. Serikbayev East Kazakhstan technical university, Ust-Kamenogorsk, Kazakhstan

E-mail: Liya_1479@mail.ru

³Lublin University of Technology, Lublin, Poland

E-mail: m.kulisz@pollub.pl

METHODS OF APPLYING THE ENVIRONMENTAL APPROACH IN ARCHITECTURAL DESIGN IN MODERN RESIDENTIAL COMPLEXES

ЗАМАНАУИ ТҰРҒЫН ҮЙ КЕШЕНДЕРІНДЕ СӘУЛЕТТІК ЖОБАЛАУДА ЭКОЛОГИЯЛЫҚ ТӘСІЛДІ ҚОЛДАНУ ӘДІСТЕРІ

МЕТОДЫ ПРИМЕНЕНИЯ ЭКОЛОГИЧЕСКОГО ПОДХОДА В АРХИТЕКТУРНОМ ПРОЕКТИРОВАНИИ В СОВРЕМЕННЫХ ЖИЛЫХ КОМПЛЕКСАХ

Abstract. Designing the environment and landscapes related to human life requires, on the one hand, taking into account the values and potential of the environment, and on the other hand, taking into account human needs. Such environmental design must be carried out persistently through interaction and balance with the environment. The purpose of this study was to propose strategies for applying an ecological approach to architectural design in modern residential complexes

The research method is descriptive, analytical and applied in nature. Carrying out this research using both field and documentary methods, data collection, analysis and integration were carried out. In order to identify Weaknesses and internal weaknesses, as well as external opportunities and threats, we used a SWOT analysis model, identifying the most preferred design strategies, as well as integrating the landscapes of the external and internal environment using the QSPM matrix. The results showed that the most preferred strategy for designing open areas and landscapes, taking into account environmental vision and improving visual quality, is the approach of spatial and visual continuation with the internal atmosphere of residential complexes.

At the present stage, the state of the environment is deteriorating in large cities around the world and for several decades architectural communities around the world have been paying special attention to the environmental aspects of design and construction in order to create comfortable and sustainable urban spaces that support a favorable socio-ecological microclimate.

Keywords: Residential complex, sustainable, ecological, architectural environment, potential, design, urban space.

Аңдатпа. Адам өмірімен байланысты қоршаған орта мен ландшафттарды жобалау бір жағынан қоршаған ортаның құндылықтары мен әлеуетін, екінші жағынан адамның қажеттіліктерін ескеруді талап етеді. Мұндай қоршаған ортаны жобалау қоршаған ортамен өзара әрекеттесу және теле-теңдік арқылы табанды түрде жүзеге асырылуы керек. Осы зерттеудің мақсаты қазіргі заманғы тұрғын үй кешендерінде архитектуралық жобалауда экологиялық тәсілді қолдану стратегияларын ұсыну болды

Зерттеу әдісі сипаттамалық-аналитикалық және қолданбалы болып табылады. Осы

зерттеуді далалық және құжаттық әдістермен жүргізе отырып, мәліметтер жинау, талдау және оларды біріктіру жүзеге асырылды. Әлсіздік пен ішкі әлсіздікті, сондай-ақ сыртқы мүмкіндіктер мен қауіптерді бөлектеу үшін біз SWOT талдау моделін қолдандық, ең қолайлы дизайн стратегияларын, сондай-ақ QSPM матрицасын пайдаланып сыртқы және ішкі орта ландшафттарын біріктіруді анықтадық. Нәтижелер экологиялық көзқарас пен көрнекі сапаны жақсартуды ескере отырып, Ашық рельеф пен ландшафттарды жобалаудың ең қолайлы стратегиясы тұрғын үй кешендерінің ішкі атмосферасымен кеңістіктік және визуалды жалғастыру тәсілі екенін көрсетті.

Қазіргі кезеңде әлемнің үлкен қалаларында қоршаған ортаның жағдайы нашарлайды және бірнеше ондаған жылдар бойы бүкіл әлемдегі сәулет қауымдастықтары қолайлы әлеуметтік-экологиялық микроклиматты қолдайтын жайлы және тұрақты қалалық кеңістіктер құру үшін дизайн мен құрылыстың экологиялық аспектілеріне ерекше назар аударды.

Түйін сөздер: Тұрғын үй кешені, тұрақтылық, экологиялық тазалық, сәулеттік орта, әлеумет, дизайн, қалалық кеңістік

Аннотация. Проектирование окружающей среды и ландшафтов, связанных с человеческой жизнью, требует, с одной стороны, учета ценностей и потенциала окружающей среды, а с другой стороны, учета потребностей человека. Такое проектирование среды должно настойчиво осуществляться путем взаимодействия и баланса с окружающей средой. Цель настоящего исследования состояла в том, чтобы предложить стратегии применения экологического подхода в архитектурном проектировании в современных жилых комплексах

Метод исследования носит описательно-аналитический и прикладной характер. Выполняя данное исследование как полевыми, так и документальными методами, осуществлялся сбор данных, их анализ и их интеграция. Для того, чтобы выделить Слабость и внутреннюю слабость, а также внешние возможности и угрозы, мы использовали модель анализа SWOT, определяя наиболее предпочтительные стратегии проектирования, а также интеграцию ландшафтов внешней и внутренней среды с использованием матрицы QSPM. Результаты показали, что наиболее предпочтительной стратегией проектирования открытой местности и ландшафтов с учетом экологического видения и улучшения визуального качества является подход пространственного и визуального продолжения с внутренней атмосферой жилых комплексов.

На современном этапе в больших городах всего мира ухудшается состояние окружающей среды и уже несколько десятилетий архитектурные сообщества по всему миру обращают особое внимание на экологические аспекты проектирования и строительства, чтобы создавать комфортные и устойчивые городские пространства, поддерживающие благоприятный социально-экологический микроклимат.

Ключевые слова: Жилой комплекс, устойчивый, экологичность, архитектурная среда, потенциал, проектирование, городское пространство.

Introduction. In contemporary society, cities act as a magnet for a multitude of people and are growing at such rapid rates that urban planners are struggling to address numerous issues, particularly those related to ecology [1]. The development of the economy and the increase in urban population have significantly increased the consumption of energy resources in buildings [2]. In recent decades, Qazaqstan has been paying great attention to the environmental state of major cities and the conservation of energy resources, driven by the consequences of the urbanization process and social factors such as industrial activities and transportation, which pose a threat to the environment. Architectural and compositional environmental solutions play a crucial role in shaping an ecologically safe city. In the modern era, several major metropolises worldwide face pressing environmental issues. Environmental safety is one of the key indicators of a comfortable environment and the high quality of life for people in cities. The study of environmental issues and their solutions is multifaceted. An overview and study of scientific works have revealed several trends. According to Polish researchers, the landscape reflects all the changes occurring in individual elements of the environment as a result of urban development. Understanding the dynamics and scale of these transformations can improve ecological design and technologies. The «principle of visibility to others» is based on the conclusions of Jacobs, Newman, and White [3]. They assert that people feel safer in cities when they are not isolated

from contact with the larger urban space. In the city of Astana, a series of specific measures have been adopted to improve the ecological situation. One such initiative is the “Astana Green” program, which is aimed at maximizing the greening of the city and implementing constructive measures in the field of energy efficiency and ecology in various areas of activity, including architecture and construction. Considering the natural-climatic features of Northern Qazaqstan and due to high urbanization, environmental problems have arisen, where a significant portion of the population in the Northern Qazaqstan region is influenced by emissions of industrial origin (Table 1).

The main sources of environmental imbalance in the cities of Astana, Pavlodar, Kokshetau, and Kostanay are the following factors:

Traffic congestion, where the source of environmental pollution is the exhaust gases from gasoline and diesel fuel, leading to the accumulation of harmful impurities in the atmosphere.

Emissions from industrial enterprises (Pavlodar city, TOO PNHZ, and AO “Aluminum of Qazaqstan”).

Low air space ventilation levels in populated areas, leading to the accumulation and concentration of pollution at ground level in the atmosphere, maintaining high levels there (Table 2).

This table provides data on the average emissions into the atmosphere from stationary sources, measured in thousands of tons, for the specified regions of Qazaqstan over the years 2016-2022.

Table 1. Emissions from Stationary Sources in Qazaqstan (2016-2022)

Region	Years						
	2016	2017	2018	2019	2020	2021	2022
Akmola	86	94	87	85	77	77	77
Kostanay	92	99	115	124	130	123	123
Pavlodar	553	543	610	710	712	723	737
North Qazaqstan	75	78	76	75	75	75	62
Astana	56	62	60	56	65	62	63
Qazaqstan (total)	2 180	2 271	2 357	2 446	2 483	2 441	2 407

According to statistical data from 2016-2022, the assessment of air pollution level due to emissions of harmful substances is determined based on three quality indicators:

Standard Index(SI) – maximum one-time concentration of pollutant divided by the Maximum Permissible Concentration (MPC);

Greatest Repeatability (GR) – percentage of MPC exceeded by air pollutants;

Atmospheric Pollution Index (API) – coefficient of atmospheric air pollution. Thus, the degree of air pollution is evaluated by these three standard indicators SI, GR, API (Table 3).

Table 2. Air Quality and Air Pollution Data in Qazaqstan (2022)

№	Level of air pollution	Cities in the Region	Quality Indicators
---	------------------------	----------------------	--------------------

1	high	Astana city, Pavlodar city	SI-5-10, GR-20-49%, API-7-13
2	Elevated		SI-2-4, GR-1-19%, API-5-6
3	Low	Kokshetau, Qostanay, Petropalsk	SI-0-1, GR-0%, API-0-5

Table 3. Air pollution levels in the territory of the Northern regions of Qazaqstan are being considered

Cities of North Qazaqstan	Points from 1 to 7
Astana	7
Qostanay	4
Kokshetau	0
Petropavlsk	3
Pavlodar	3

Materials and methods of research.

The scientific research was based on strategic approaches to rational spatial planning, their concepts and categories, as well as the fundamental principles of modern architectural composition theory. Scientific-theoretical methods of cognition based on a systematic approach to solving the set problem were used as the methodological basis.

In particular, scientific works of authors from Spain, the USA, Germany, Poland, Malaysia, Bangladesh, and Jordan related to research in the field of modern ecological requirements and residential complexes within large cities to ensure a comfortable standard of living for the population were studied.

To achieve the goal of the scientific work, a set of general scientific research methods was used;

- Synthesis method – development of scientific work on the issue of ecological residential complexes, considering not only urban planning norms and standards but also the development of infrastructure facilities and an extensive transportation system, management of landscaping processes, and effective spatial planning.

- Empirical analysis method – the role of ecological residential complexes in the modern development of a large city and the features of modernizing comprehensive plans of residential areas implemented within the city's structure.

- Generalization method – fundamental issues in the sphere of regulatory control of urban planning norms and standards.

- Inductive method – a group of fundamental urban planning principles considered in the formation of residential complexes; modern classification of ecological residential complexes using the example of the city of Astana.

The scientific research and subsequent article writing consisted of several stages.

The first stage involved examining the essence of the concept of ecological residential complexes within the framework of comprehensive spatial organization of the city. Additionally, the need for modernizing existing residential areas and improving the level of regional landscaping through the enhancement of social, transportation, medical, educational, entrepreneurial, tourist, and recreational infrastructure was substantiated.

The next stage involved the analysis of specific components that are crucial in the formation

of ecological residential complexes. In particular, key problematic issues related to regulatory control of all architectural and planning decisions and town landscaping were identified.

The penultimate stage involved defining and providing detailed justification for a group of fundamental urban planning principles. Specifically, the main elements within the comprehensive functioning system of the settlement were identified, according to which residential complexes should be renewed.

Let's take an example of the application of an ecological approach in the architectural design of the residential complex «Green Quarter». The project of the residential complex «Green Quarter» (covering an area of 20.5 hectares) was presented by the «BI group» team and foreign specialists from England and Austria according to the standards of Leadership in Energy and Environmental Design. This project gives the left bank of the city of Astana a new rhythm and direction in innovation, technology, and an ecological comfortable environment. Innovations such as wind generators, water conservation, and smart home technology were implemented in the residential complex.

Regarding the exterior finishing of the facades, environmentally safe and temperature-resistant facade panels Kmew are currently being used. These panels have a layered structure, including quartz sand, cement, cellulose fibers, and water. By introducing an additional layer of elastic microgranules into the material, a porous structure is achieved, giving the fibercement panels properties of moisture resistance and frost resistance. The color range of the panels is formed by an organic acrylic coating. The structure of the material is completed by a self-cleaning layer, which is a photo-ceramic deposition, providing protection against the settling of harmful particles of exhaust gases and dust. Research conducted in the laboratory [4] has shown that Kmew panels, used for cladding a facade area of 170 m², are capable of purifying the air as effectively as 12 poplar trees.

Special aluminum insulated glass units «Garden» were used in the construction of the «Green Quarter» complex. These units are capable of reducing heat loss in the room by 2-3 times, which is especially important in the conditions of the prolonged winter season in this region. At the same time, during hot summer days, these insulated glass units reflect excess ultraviolet rays outward. These units have high efficiency compared to regular ones, maintaining a comfortable temperature in the rooms both in summer and winter, which helps save energy for heating and conditioning the building.

It is important to note that the proper choice of materials for enclosing structures, meeting the requirements of energy efficiency, durability, stability, and adapted to weather conditions, is a key aspect in providing comfortable living conditions. The «Green Quarter» is one of the first projects within the «Astana green city» program, meeting modern standards of «green» architecture.

These special aluminum «Garden» insulated glass units make a significant contribution to increasing energy efficiency and creating a comfortable environment for the residents of the «Green Quarter» residential complex.

In the analysis of environmental safety, the concept of «territoriality», «natural surveillance», and «social control» is used. This concept was developed by the American architect Oscar Newman and described in the book «Defensible Space». The data collection and analytical research also include: field methods, study of internet resources, innovative facilities, literary sources, photo documentation, sketching, and conducting personal interviews, using deductive methodology in developing proposals for reconstruction and strategic development [5].

Based on the photo documentation of current problems related to environmental safety, a map of the area was analyzed. The map outlines the contours of buildings, and, in accordance with the adopted experimental methodology for constructing the spatial body of voids, the free three-dimensional volumes of urban territory free from buildings were determined [6].

In spatial «bodybuilding», negative areas that, according to researchers, do not meet environmental safety criteria are marked in red. As a result, researchers obtain a map with volumetric parameters of negative areas.

Subsequently, to confirm assumptions, researchers conduct field studies to analyze the terrain through visual observation, empirical data, and photo documentation. If necessary, measurements and interviews with residents are conducted [7].

Results and discussion.

Document Analysis Results

Thematic materials, scientific research, archival documents, and other sources were analyzed during this study, allowing for the identification of modern trends in the development of residential complexes.

Urban planning trends:

- strengthening of multifunctionality;
- development of auxiliary centers;
- increase in building height.

Scientific and technical trends:

Modernization and development of technologies in the field of construction and design.

Socio-economic trends:

- increase in residential areas and expansion of the range of functional elements;
- various ways of interaction between residential, business, and public spaces;
- integration of work zones into residential environments;
- combination of residential elements with the system of citywide cultural and leisure spaces;
- socio-economic integration of the population in the complex structure.

Environmental trends:

- use of ecological materials;
- energy efficiency;
- resource conservation.

After analyzing the modern trends in the formation of residential complexes, a high degree of urbanization of the residential environment can be identified, leading to a significant increase in residential, public, and business spaces [8].

Population Survey Results.

During the population survey, the main requirements for shaping the residential environment and its comfort criteria were identified. These requirements are formed depending on the socio-economic status of the residents, family composition, and occupation.

The collected data from the population survey were systematized, leading to the identification of the main factors influencing the architectural and planning structure of the residential environment. The primary factors include:

- socio-economic
- urban planning
- natural-climatic
- environmental
- scientific and technical

Results of Field Study.

The results of the field study revealed the following:

In the majority of cases (95%), there is a uniform functional saturation of residential complexes.

The architectural and planning solutions of residential structures do not consider the specificity of the surrounding context.

«Typical» architectural and planning solutions for residential areas.

Low ecological sustainability in the applied design and construction methods.

Narrow socio-economic focus of the residential complex.

As a result, additional assessment criteria were formed for architectural and planning solutions, determining the level of interaction with the urban structure and their comfort level with the residential environment [9].

Architectural Design.

Analyzing the evolution of the architectural and planning formation of residential complexes, methods of spatial interaction of the main functional elements, details of structural, technical, and architectural planning design are the principles of organizing residential complexes.

A group of socio-economic principles is aimed at uniting people of different socio-economic status, their types of activities, and interests, providing privacy of personal spaces in the structure of a multifunctional residential complex.

Urban planning principles are based on the compositional and volumetric significance of the residential complex in the urban structure. In the course of the research, it was established that conditions arise for the formation of a structure with mutual penetration of business and residential elements [10].

A group of scientific and technical principles will contribute to the creation of flexible architecture, which reduces the dependence of social needs on structural elements and controls a large part of technical processes.

A group of natural-climatic principles is aimed at creating green architecture, which creates diverse natural elements in the structure of the residential complex.

A group of ecological principles will lead to the creation of ecological architecture, which shapes ways of obtaining and conserving various types of energy in residential complexes and is aimed at the ecology of the urban structure.

The identified principles are aimed at creating a comfortable residential environment that takes into account the population's requirements and modern trends.

Experimental Design.

At the next stage of the conducted research, the identified theoretical basis transitioned into the stage of experimental design of a residential complex. The main parts of the sketch project (floor plans, sections, facades, and perspective images) were developed, the architectural and planning solutions of which took into account the identified principles [11]. As a result, a new structure of the residential complex was created, which provided more comfortable living conditions and better ways of interacting with the surrounding environment.

Expert Survey Results.

The expert survey allowed to establish that the attitude towards the architectural and planning structure of the residential complex largely depends on the competence of the expert. It should be noted that 82% of the experts noted the social significance of the proposed solutions, as well as a not significant increase in the cost of the construction project. The majority of the experts noted the importance of applying urban planning principles, which are aimed at the aesthetic and structural formation of urban areas.

Results of Implementation in Production.

Experimental design allowed for the development of a series of architectural and planning solutions aimed at enhancing the comfort level of the residential environment. These solutions were used in the design and construction of several residential complexes with integrated spaces and parking, demonstrating not only their practical value but also their socio-economic relevance [12].

Taking into account all aspects such as the annual population growth of the city, ethnic di-

versity, the concentration of major educational institutions, business structures, etc., it is necessary to develop conceptual proposals to address the problem of atmospheric air pollution. It is proposed to draw from the experience of the Superkilen Park (Figure 1). The experience of Superkilen Park in Copenhagen not only allowed for air purification but also contributed to a reduction in crime in the city (Figure 2).

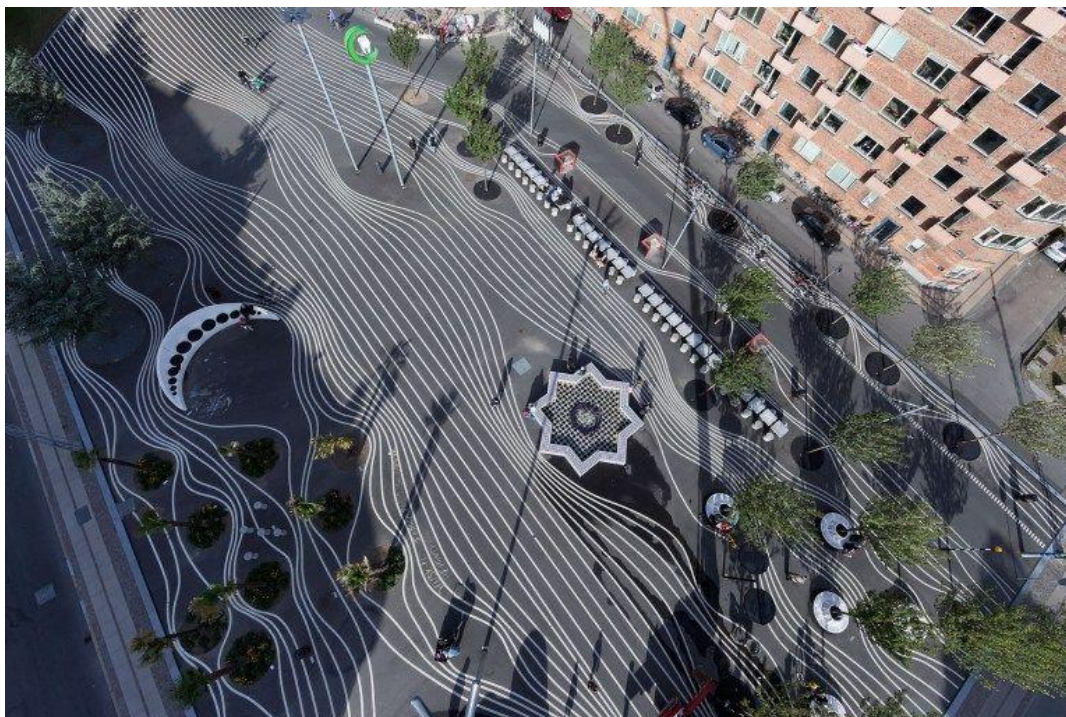


Figure 1. «Superkilen Park», Qazaqstan, Astana city (authors' materials)

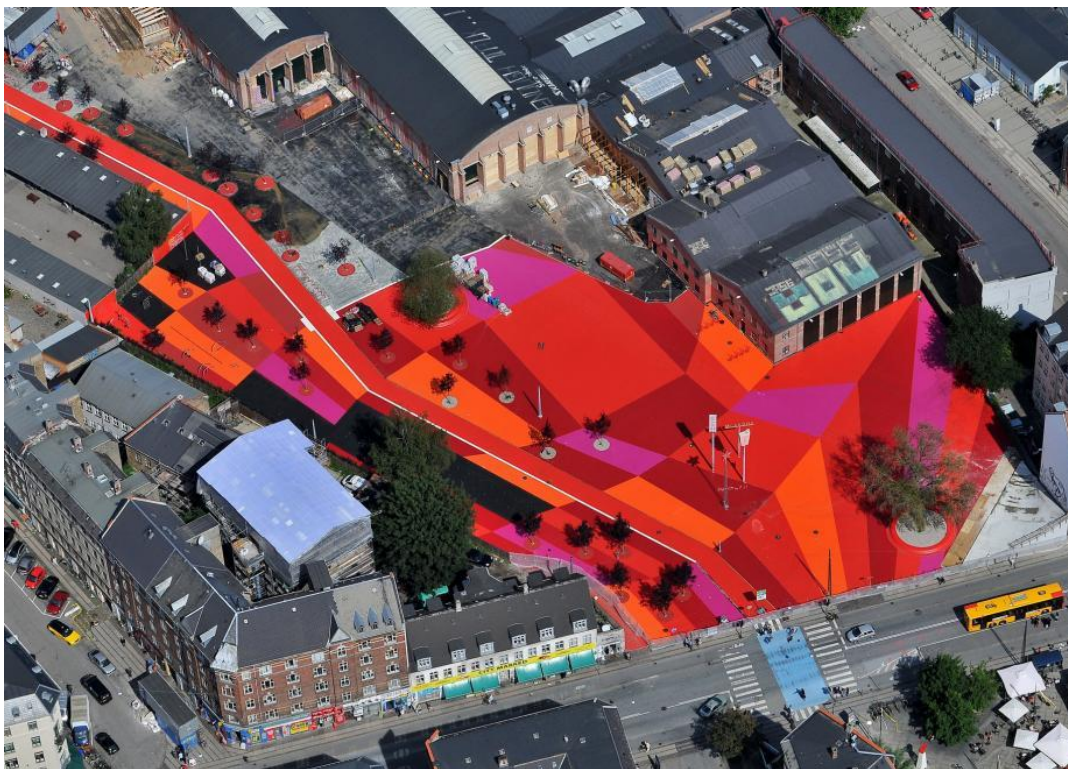


Figure 1. «Superkilen Park», Qazaqstan, Astana city (authors' materials)

This type of participation is aimed at developing a sense of belonging to the park among the residents of the area. Many real estate properties proposed by the residents are associated with their native cities and countries [13]. As a result, trees used in the park are also intended to represent various geographical regions and nationalities present in the park. For example, the Lebanese cedar is associated with Lebanon, the Atlas cedar with the Atlas Mountains between Morocco and Algeria, and the windmill palm with eastern China. Furthermore, a special mobile phone application has even been developed to provide more detailed information about these sites and their history. This park has become one of the most popular recreational areas for the residents and guests of Copenhagen.

Discussions. The analysis and summarization of the collected material during the conducted research have allowed for the identification of modern trends in the development of residential complexes.

Urban planning trends aimed at creating comfort in urban areas under conditions of urbanization.

Scientific and technical trends related to advanced engineering solutions.

Socio-economic trends focused on population interaction.

Ecological trends stemming from the concept of sustainable development.

Global trends illustrate a wide range of techniques in the field of architectural and spatial organization of residential complexes, allowing residential structures to maximally correspond to the socio-economic requirements and priorities of modernity.

Qazaqstan is rapidly developing in the face of globalization, technological growth, and scientific advancements. The country is following modern architectural trends in the construction of residential, public, and administrative buildings. Various architectural innovations, such as the use

of new construction technologies and materials, and structural systems, are being implemented through the exchange of experiences with foreign architects [14]. More international projects are being erected, involving both renowned foreign architects and local design organizations.

The authors have identified and systematized methods for forming residential complexes during the research process. New socio-economic needs and conditions require a new approach to shaping the architectural and planning structure of residential complexes, forming a method of socio-economic principles, including the principles of: concentration of residential, public, business, and social-domestic functions in one object or building complex; functional zoning of the main building elements; variability of layouts for residential apartments and public-business premises; spatial stimulation of social communications; and socio-economic differentiation principles for residential groups [15].

Thus, the application of socio-economic principles contributes to the creation of social architecture, aiming at functional homogeneity of urban areas, formation of public social spaces, leveling of socio-economic differentiation of the population, and the autonomy of each main element of a residential complex.

Principle of Urban Planning. The principle of urban planning is based on the compositional and volumetric significance of residential complexes in the urban structure. This method encompasses the following principles:

- structural compliance with urban planning conditions;
- volumetric-spatial creation of the building's form;
- fixation of the horizontal levels of adjacent buildings;
- planning safety of residential areas;
- rational development of the territory.

Thus, the application of urban planning principles in the structure of the residential environment will lead to the fulfillment of the requirements of this factor and will contribute to the creation of an architecture of interaction, where connecting elements of the urban structure form a unified whole.

In connection with this, the following problems will be solved:

- overload of the urban transport network;
- formation of new centers of public housing in the middle and peripheral urban areas;
- alignment of the functional structure of urban districts;
- restoration of the expressive silhouettes of urban development.

Scientific and Technical Principles. The main directions of scientific and technical progress in the construction and operation of residential complexes are: increasing the share of automation and mechanization in the construction industry and progressive engineering solutions, which create new building materials and methods of working with them. As a result, architectural and planning solutions are improved, increasing the level of comfort in residential structures [16].

Thus, a group of scientific and technical principles is formed, including: the principle of adapting structural elements of the residential environment; the principle of maximum use of underground and aerial space; the principle of regulating natural lighting; the principle of technical equipment; the principle of reserving structural-engineering resources and areas.

Thus, the application of scientific and technical principles will lead to fulfilling the requirements of this factor and will contribute to solving the following problems:

- transformation of premises;
- territorial shortage of land resources;
- control of technical processes in the complex structure;
- possibility of complex development.

Natural-Climatic Principles Due to rapidly changing socio-economic conditions of urban

population life, there is a desire to connect with nature, an increasing inclination towards active recreation, and a growing need for full-fledged short-term rest among trees and shrubs, allowing one to relieve stress and restore physical and spiritual strength.

The analysis of the architectural-planning structure of multifunctional residential complexes and natural-climatic requirements creates a group of natural-climatic principles, including the following principles:

- greening of the territory;
- formation of buffer spaces;
- comfortable arrangement of residential rooms;
- creation of natural and artificial natural accents;
- formation of covered semi-public spaces.

As a result, the application of natural-climatic principles will lead to fulfilling the requirements of this factor and will contribute to solving the following problems:

- greening of urban spaces and elements of residential complexes;
- reduction of the impact of uncomfortable natural-climatic conditions;
- formation of district recreational areas with natural accents.

Ecological Principles The analysis of the architectural-planning structure of residential complexes and ecological requirements creates a group of ecological principles, including:

- development of ecological transport;
- collection and utilization of household waste;
- resource conservation;
- energy efficiency;
- use of eco-friendly materials.

As a result, the application of ecological principles will lead to fulfilling the requirements of this factor and will contribute to solving the problems of increasing the ecological friendliness of urban spaces through the use of “clean” materials and “green” transport; creation of an engineering-autonomous residential structure based on the principle of self-sufficiency.

Based on the proposed comprehensive method for residential complexes, the authors formulate a conceptual and theoretical model that reflects a modern approach to shaping residential structures. This model generalizes residential complexes with similar characteristics and emphasizes the main methods of their implementation.

Theoretical models allow determining the development vector in each specific case and serve as the basis for shaping residential complexes.

The task of the theoretical model of a residential complex is to develop an optimal living environment to ensure maximum social and economic impact. This can be achieved by improving environmental conditions, enhancing economic efficiency, strengthening integration links, and more effective use of urban territories.

The spatial structure of the theoretical model of a residential complex includes the following components:

Key factors in shaping the residential environment;

Trends in forming multifunctional structures, considering the evolution of their development and modern socio-economic needs;

Universal and regional principles of creating a comfortable residential environment;

A new approach, a new vision – as a synthesis of all factors, trends, and principles.

The new approach is characterized by the synthesis of factors and trends, where the key aspect is an individual approach to organizing each specific residential complex with the possibility of its adaptation and development in accordance with the changing times. The proposed model is not static but dynamic. Ideally, the proposed model ensures self-organization, self-

development, and dynamic equilibrium of the entire structure, which is the most optimal approach in ensuring the life process.

Conclusions. Based on a comprehensive study of the ecological issues related to the organization of residential complexes, a series of conceptual and theoretical models have been developed.

The implementation of the developed concepts is supported by the proposed methods and recommendations, which define the sequence of work.

Continuing work in this direction will allow for a detailed examination of public opinion and the population's needs in the organization of residential complexes and will help identify more advanced directions in shaping the architectural and planning structure of these objects.

The future development prospects of scientific and practical research on the architectural and planning formation of residential complexes, as well as their placement in the urban structure and the developed methods and principles, will be directed towards their practical application through implementation in production – during the construction, reconstruction, and renovation of cities of various administrative and territorial significance and population sizes.

The proposed methodology can be used in design and construction organizations for the development and construction of residential complexes. It can also be utilized in educational institutions for training professionals in urban planning, architecture, and construction. Additionally, it can be employed in administrative government structures responsible for the development of construction and urban improvement.

The effectiveness of this research can be traced in social, economic, urban planning, environmental, scientific-technical, and climatic aspects.

In a socio-economic perspective, it creates an independent and self-sufficient housing structure with internal and external connections, providing comfortable conditions for the population.

From an ecological standpoint, it forms a residential element with a high level of resource conservation and energy efficiency.

In the scientific-technical aspect, the residential complex serves as an indicator of technical progress.

In terms of natural-climatic integration, the residential complex is integrated into the natural environment of the region.

In urban planning, it represents a multifunctional residential complex performing essential urban planning functions, forming a «mini-city» within the city limits.

The effectiveness of this research can be traced in social, economic, urban planning, environmental, scientific-technical, and natural-climatic aspects.

In the social-economic aspect, it creates an independent residential structure with internal and external connections, providing comfortable conditions for the population.

From an ecological standpoint, it forms a residential element with a high level of resource conservation and energy efficiency.

In the scientific-technical aspect, the residential complex serves as an indicator of technical progress.

In terms of natural-climatic integration, the residential complex is integrated into the natural environment of the region.

In urban planning, it represents a multifunctional residential complex performing essential urban planning functions, forming a «mini-city» within the city.

Today, there is a need for the implementation of a new ecological approach in architectural and urban planning design, with an increased emphasis on environmentally friendly architectur-

al techniques. The ideal guidance for ecological design should be understandable and widely accepted, flexible, recognize local differences, encourage the broadest possible participation of related specialists outside the project, including the government, as well as non-governmental organizations, community groups, environmental organizations, scientists, individual community representatives, take into account the interrelationships between the economy and society, be accompanied by recommendations for eco-construction, develop professional skills, and improve public ecological awareness.

References

1. Ибрагимова А.А., Исабае Г.А. Формирование экоустойчивых кварталов в ряде зарубежных и региональных городов// Вестник Казахской головной архитектурно-строительной академии. 2020. – № 4(78). – С. 40-44. DOI: <https://doi.org/10.51488/1680-080X/2020.4-06>
2. Neng Zhu, Xiangzhe Liu, Qi Dong, Dragan Rodrigues Optimization of zero-energy building by multi-criteria optimization method:A case study // Journal of Building Engineering, vol. 44, 2021, 102969. DOI: <https://doi.org/10.1016/j.jobe.2021.102969>
3. Сухинина, Е.А. Композиция гелиозданий с использованием новейших архитектурноинженерных решений / Е. А. Сухинина, Н. В. Лобанова // Наука, образование и экспериментальное проектирование. Труды МАРХИ: материалы Междунар. науч.-практ. конф. – 2022. – С. 274-278.
4. Мамедов С.Э. Принципы архитектурно-планировочного формирования жилых комплексов в изменяющейся социальной структуре города: Диссертация на соискание степени доктора философии (PhD), доктора по профилю «Архитектура», 2020 г., Нур-Султан. -260с.
5. Мамедов С.Э., Байдрахманова М.Г. Экологический аспект в архитектуре «Марсельской жилой единицы» // Вестник Казахской головной архитектурно-строительной академии. 2021. – № 1(79). – С. 98–103. DOI: <https://doi.org/10.51488/1680-080X/2021.1-13>
6. Akhmedova, E. Urban information spaces as the basis of the system “Smart City” / E. Akhmedova, A. Zhogoleva, A. Teryagova // IOP Conference Series: Materials Science and Engineering. – 2020. – Vol. 775. – Pp. 012003. – DOI 10.1088/1757-899X/775/1/012003.
7. Казарян Р.А. Развитие современных городов с позиции экологического подхода. Экономика строительства и природопользования, №1(78), 2021, стр. 28–34. URL: <https://www.elibrary.ru/item.asp?id=45803453>.
8. Аймагамбетова З.Т., Ибраева Ж.Б. Аспекты формирования комфортной городской среды// Вестник Казахской головной архитектурно-строительной академии. 2021. – № 3(81). – С. 15–21. DOI: <https://doi.org/10.51488/1680-080X/2021.3-02>
9. Sukhinina, E. Comparative analysis of environmental assessment systems of universities in Russia and China (using the example of Green Zoom «Universities and campuses» and GB/T51356-2019) / D. Iakimovich, E. 10. Sukhinina, V. Sirotkin, B. Usmanov, A. Kuleshov // Urbanism. Architecture. Constructions. – 2022. – Vol. 13 (1). – Pp. 45-60. – URL: <https://uac.incd.ro/EN/index.htm>
10. Sukhinina, E. Justification of educational institution environmental reconstruction in accordance with the UI Green Metric rating and environmental standards / E. Tichomirova, E. Sukhinina // Urbanism. Architecture. Constructions. – 2021. – Vol. 12 (1). – Pp. 1-12. – URL: <https://uac.incd.ro/EN/index.htm>
11. Sukhinina, E. A. Aspects of ecological engineering as an innovative technology for architecture and construction sphere development / E. A. Sukhinina, O. N. Kiseleva, S. F. Dyadchenko // III International Scientific Conference: Agritech-III-2020: Agribusiness, Environmental Engineering and Biotechnologies. – 2020. – p. 62005. – doi:10.1088/1755-1315/548/6/062005
12. Сухинина, Е.А. «Зелёное» строительство с учётом требований международного экологического стандарта SBTOOL / Е.А. Сухинина // Традиции и инновации в строительстве и архитектуре. Архитектура и градостроительство: сб. статей 79-й Всерос. науч.-техн. конф. – 2022. – С. 303-311.

13. Сухинина, Е.А. Композиция гелиозданий с использованием новейших архитектурноинженерных решений / Е.А. Сухинина, Н. В. Лобанова // Наука, образование и экспериментальное проектирование. Труды МАРХИ: материалы Междунар. науч.-практ. конф. – 2022. – С. 274-278.
 14. Сухинина, Е. А. Концепция безуглеродного дома для Саратова / Е. А. Сухинина, А. С. Курдиян // Здания высоких технологий. – 2022. – С. 78-85.
 15. Сухинина, Е.А. Особенности малоэтажных заглубленных зданий для природноклиматических условий Саратова / Е.А. Сухинина, Е. А. Землянская, А. М. Меллер // Традиции и инновации в строительстве и архитектуре. Архитектура и градостроительство: сб. статей 79-й Всерос. науч.-техн. конф. – 2022. – С. 466-475.
 16. Сухинина, Е.А. Алгоритм экооценки архитектурно-градостроительных объектов с учётом требований «зелёных» стандартов / Е.А. Сухинина // Экологический мониторинг опасных промышленных объектов: современные достижения, перспективы и обеспечение экологической безопасности населения: сб. науч. тр. по материалам 3-й Всерос. науч.-практ. конф. – 2021. – С. 182-186.
-
-