



IRSTI 55.19.03

<https://doi.org/10.32523/2616-7263-2024-149-4-128-144>

Article

Organization of spatial structure of cities on the basis of architectural design code on the example of almaty city

D. Almukasheva*¹, G. Maulenova¹, D. Nazarova²

¹Kazakh National Research Technical University named after K.I.Satpayev, Almaty, Kazakhstan

²Tashkent Architecture and Construction University, Department of Urban Planning and Landscape Architecture, Tashkent, Uzbekistan

(E-mail: *d.almukasheva@cu.edu.kz)

Abstract. This article explores the problem of organizing the spatial structure of cities and solving this problem with the help of architectural design codes, such as the city of Almaty. The issues of the illumination of principles and design approaches to create a harmonious urban environment, the development of algorithms, and the implementation of architectural design codes present the problems of the organization of the architectural and urban planning environment, as in the example of the city of Almaty. The article is based on research conducted in Almaty, Kazakhstan's significant economic and cultural center. The article presents an approach based on architectural design code as a tool to overcome the difficulties in planning and development of the urban environment. The article discusses the basic principles in developing architectural design codes for urban environments. Special attention is paid to creating a unique identity for the city, ensuring sustainability and accessibility of urban spaces, and creating a balance between modernity and preservation of cultural heritage.

Keywords: architectural design code, pedestrian space, streets, urban environment, urban planning.

Received 22.10.2024. Revised 23.10.2024. Accepted 19.11.2024. Available online 31.12.2024

*the corresponding author

Introduction

Modern cities are complex and dynamic organisms, similar to living organisms, constantly developing and transforming under the influence of social, economic, and cultural factors (Yoshiki & Perry, 2020). Each city has its own unique architectural structure that reflects its history, values, and inhabitants' needs. The spatial organization of cities plays a key role in creating a comfortable and functional urban environment to meet the needs of different social strata of the population (Yan et al., 2024).

The Architectural Design Code is a set of rules, principles, and standards designed to regulate architectural activities in cities and ensure their coherence with overall development goals. This approach to organizing the spatial structure of cities is a vital tool for achieving harmony between urban development, the environment, and the needs of its inhabitants.

One of the most exciting and illustrative examples of a city in which the city department «Almatygenplan» is trying to introduce an architectural design code, which is currently at the stage of discussion with the citizens (<https://legalacts.egov.kz/npa/view?id=14847560>) to organize the spatial structure, is Almaty – the largest city and former capital of the Republic of Kazakhstan. Almaty is known for its ancient and rich history and diverse cultural heritage. In recent decades, the city has witnessed significant growth and development, which entailed various aspects of urbanization and necessitated the introduction of modern approaches to spatial organization.

The purpose of this article is to review and analyze the organization of the spatial structure of Almaty City based on the architectural design code. It will consider the fundamental principles and standards that define the development of the city and their impact on the formation of a unique image of Almaty, as well as assess the achieved results and challenges faced by the city administration in the implementation of the architectural design code.

The research hypothesis is to study the architectural design code for the city of Almaty. This will identify the key structural elements that influence the organization of space in the city, which can contribute to improving the layout and development of sustainable urban spaces.

The methodology

Urbanization is becoming increasingly relevant in today's world as more and more people seek to move from rural to urban areas in search of better opportunities and quality of life (Yang et al., 2023). However, preserving the city's unique look and style is an urgent problem for the urban architect. After all, the city is a complex spatial planning structure located under intensive new development and reconstructed historical environment conditions.

At the core of the fabric of the historic city are locally established socio-spatial structures - components of the urban environment with "attached" values and social meanings that need to be identified. (Caniggia and Maffei, 2001). Generally, the fabric of a historic city is morphotypic. A morphotype is an evolutionary variety of planning and spatial organization of urban development (Selby et al., 2019). Naturally, each of the morphotypes in a particular city is purely individual, peculiar to this particular city's features and flavor. (Maretto, 2014) According to K.

Lynch, the urban structure consists of five essential elements (paths, nodes, cells, boundaries, landmarks) of urban composition, operating with which it is possible to model almost any environmental subject (Levy, 1999).

A city is a whole object. However, the urban planner and architect-urbanist perceive the city as something other than one from the point of view of architecture. Buildings can be in the same style, even all elements such as sidewalks, roads, squares, parks, location of institutions, but their integrity and connection and create an urbanized or compositional framework, which is part of the urban fabric and provides the cohesion of its essential planning elements (Oliveira, 2021). The urbanized framework forms a stable, over-time basis for the city's layout. An urbanized (compositional) framework can be called an interconnected hierarchical system of compositional centers (nodes, dominants), spatial axes, and links between these centers (Potaev, 2014). It includes the most intensively developed and well-accessible parts of the urban area. If we abstract and consider the city as a holistic spatial structure (following the example of Kazimir Malevich's architects in one neutral material, only on an urban planning scale), then the most dimensional voids (open spaces between the fabric of buildings) will be the very urbanized frame. It should be noted, however, that this applies only to a coherent urban fabric with a clear structure. A fragmented fabric with gaps and unclear morphology requires reconstruction, and open spaces should be compacted and structured about the integral compositional structure. According to A.E. Gutnov, the framework is "the leading, structure-forming part of the urban planning system, which covers the area of concentration of functional activity of the most massive processes of life activity of the population, associated with high intensity of space development. The framework of the urban planning system is formed by the main transport highways, communication nodes, and associated structures of urban significance- public, business, and other unique complexes that attract mass flows of visitors.

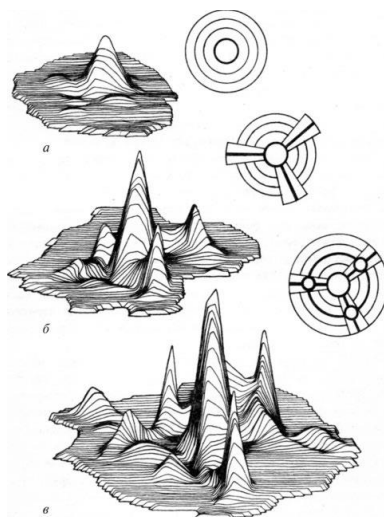


Figure. 1. Changes in the relief of the intensity of land development in the process of growth cities
a – concentric structure; b – sectoral structure; c – multinuclear structure (mutual superposition of concentric and sectoral) (by A. Gutnov)

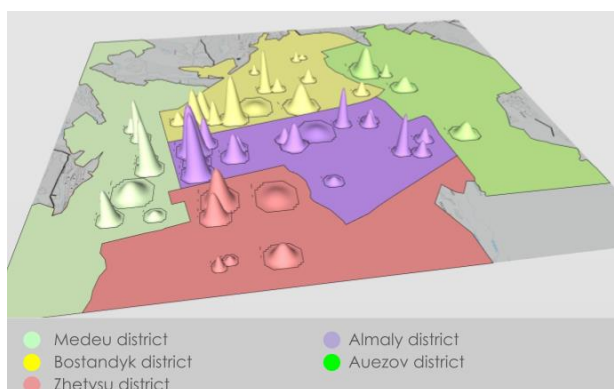


Figure. 2. Relief of the intensity of land development in the process of growth Almaty city for 2023 (Source: Author)

The sector and multi-core structure of the city is as close as possible to current urban development. We are increasing the number of public and residential centers and the density of development. This divides the city into modern and historical parts over time, requiring a different approach to design. The cities with a center formed over the last decades are characterized by the problem of choice of functional orientation, monotony of the environment, the presence of vacant territories, the problem of harmonious integration of new objects into the existing development, and high costs.

In order to identify the problems of work of the composite framework of the city. Visual analysis was carried out in Almaty (Fig.3). Visual contact with the architectural environment allows you to visually highlight several features of the volumetric and spatial organization of the architectural environment to capture individual mise-en-scene of public space (Inglis et al., 2022). Visual analysis consists of assessing the aesthetic and compositional characteristics of the object and determining the optimal points of perception of the ensemble.

In the site survey process, the visual boundaries of the ensemble territory and the zones of the public space formed in the form of gravitation zones are marked. The result of the visual analysis is the identification of the compositional role of the architectural ensemble elements in the public structure and the semantic logic of the relationship between the centers of attraction and people's activities in the public space. The obtained material serves as a basis for scenario modeling of the object (Fig. 3).

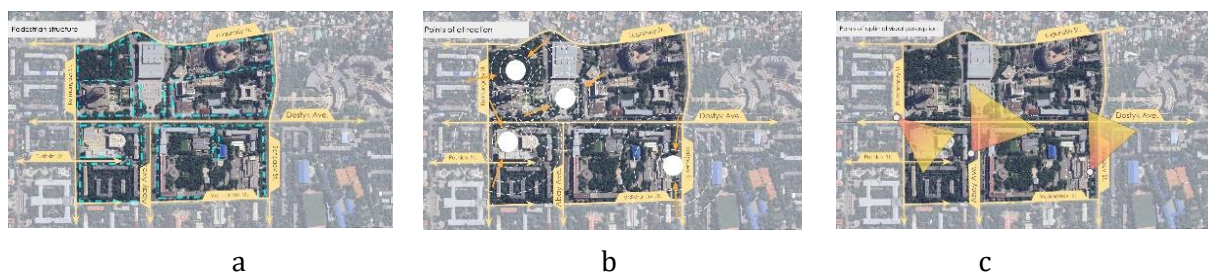


Figure. 3. Analysis of the linear-nodal public space of Almaty city

a – pedestrian structure; b – points of attraction; c – points of optimal visual perception; (Source: Author).

Compositional analysis evaluates the compositional integrity of the ensemble and its fragments, cognizant of the regularities of the construction of artistic images. The results are applied in the development of the formation of architectural design codes (Moughtin, 2003).

We can identify several negative nuances by analyzing and evaluating the composite framework of Almaty's urban environment. Firstly, one of the acute problems is the congestion of the street network, i.e., transportation chaos and traffic jams. With population growth and car fleet, the city faces overloaded road networks and the need for efficient public transportation systems. This makes it difficult for city dwellers to get around, leading to air pollution and increased time spent on transportation movements.

Secondly, an accessible urban environment has not been created, and it also narrows the space of movement for people with low mobility. There are no complaints about the quality of the sidewalk areas; they are periodically reconstructed, and sidewalk tiles are brought to a proper form, which will not create obstacles, but the underpasses and ramps in the pedestrian part are incorrectly designed, which hinders the movement of people with disabilities – in this regard, paying attention to the underpasses, building either decent ramps or elevators there (which is less possible), or modernizing the underpass into a street overpass.

Thirdly, one of the problems is the lack of clear zoning of urban space, monotony of small architectural forms, and lack of "image" of the city. These problems create a pedestrian outflow from the streets and negatively affect tourism.

The solution to these problems is possible only if there is a clear compositional structure and semantic and visual diversity of its elements, creating a transformable environment that is a source of positive, diverse emotions and harmony of interaction with the environment.

The methods of sociological survey on the level of comfort of urban spaces and structural analysis were used for in-depth analysis to identify problems in the organization of Almaty's subject-spatial environment. The collected data are presented in tables (tab.1-2).

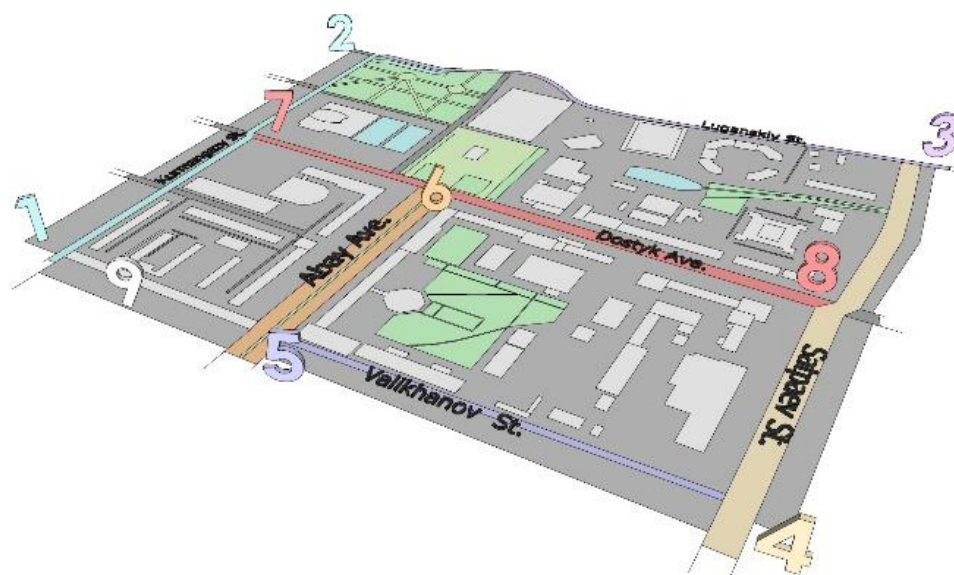


Figure 4. Location of survey and sociological poll in Almaty city within the boundaries of Kurmangazy – Luganskogo – Satpayev – Valikhanov streets (Source: Author).

Table 1. Results of the analysis of urban architectural spaces in Almaty based on social survey (Source:

Author).

Survey location	Element	Identified problems on the basis of sociological survey	Recommendations for future development
Survey location 5-6 (Valikhanova-Abay-Dostyk)	Yard space	<ul style="list-style-type: none"> - Narrow walkways; - playground elements have insufficient aesthetic appearance and a low level of safety; - There is no zoning of the yard territory: there is no structurally separated zone for children, teenagers, adults and elderly people; - Many residents note that the number of users of the yard has decreased due to the lack of sports equipment; - The seating is not spacious enough and not safe; - low percentage of landscaping in the yard; - Pedestrian accessibility problems in the yard, approaches to entrances and sidewalks are used as parking lots; - absence of elements for low mobility groups; - facades of residential buildings have insufficiently 	<ul style="list-style-type: none"> - Placement of secure bicycle parking in the courtyard; - organization of a sports ground; - increase in parking spaces; - reorganization of children's playgrounds; - design of ramps and other elements for low mobility groups;
2-3 (Kurmangazy-)	Pedestrian space	<ul style="list-style-type: none"> - unsafe crossing of the roadway by pedestrians; - low road surface level; - shortage of parking spaces near frequently visited facilities; - Lack of pedestrian space by widening roadways; - insufficiently aesthetic architectural appearance of buildings and structures; - insufficient level of landscaping; 	<ul style="list-style-type: none"> - Increased security; - Renovation of the architectural appearance of buildings; - Increase in parking spaces; - Increased landscaping; - Expansion of pedestrian areas;
6-7 (Kurmangazy-Dostyk-Abay)	Square / public garden	<ul style="list-style-type: none"> - environmental pollution due to irrational placement of parking lots; - insufficient level of improvement; - Irrational alignment of pedestrian paths within the green space structure; - lack of bicycle traffic routes; - insufficient seating; - low functional diversity; - insufficiently developed green framework of the territory; - deviant behavior develops due to poor environmental formation; 	<ul style="list-style-type: none"> - Formation of a rational and safe pedestrian network; - increasing the share of green spaces; - Rationalization of vehicle traffic and parking spaces; - formation of a convenient and accessible pedestrian network for low mobility groups; - increase in the number of seating areas; - development of the green framework of the territory development of multifunctionality of the territory.

The analysis of answers indicates that the population sees the perspective of city development in deurbanization, decolonization of the environment, and uniform greening of territories. Although the city is the southern capital of the country, the sociological survey shows that the structure, layout, and interior of streets require significant improvement.

Residents within the boundaries of Lugansky-Kurmangazy-Ualikhanova-Satpayev streets, students of nearby universities, pensioners, schoolchildren, and tourists participated in the survey. About 100 respondents participated in the survey; the survey questioning the city's residents was conducted in person (individually), and data processing took about a month. The survey showed that most citizens want to experience the urban environment above the specified street boundaries.

The survey results confirmed the hypothesis that a comprehensive approach is needed in the form of Almaty city's developed architectural design code to design the urban environment, taking into account the development of sustainable urban spaces. The city needs ecologization, increasing infrastructure saturation, and improving the quality of the living environment.

Table 2. Assessing the quality of pedestrian spaces in terms of their efficiency of functioning (Source:Author).

Evaluation scale for pedestrian space performance level				Quality indicators of pedestrian spaces in Almaty city														
				Mobility (dynamic)			Physical comfort (static)			Social comfort				Multifunctionality of the environment (conversion)				
Survey location (section)	Efficiency class	Generalized efficiency assessment	Assessing the effectiveness of pedestrian transit	Width	Transitability	Intuitive navigation	The interrelationship of static and dynamic.	Seating arrangement	Environmental conditions	Conditions for	Conditions for safety	Order and tidiness	Illumination	Videoecology	Barrier-free	Multifunctionality	Equal distribution of penetration sites	Adequacy of parking space allocation
2-3	D	2,41																
3-4	C	3,29																
4-5	C	2,6																
5-6	C	3,58																
7-8	C	3,13																
1-9	C	2,72																
Level of quality of pedestrian spaces				2,9	3,7	3,02	2	2,3	1,7	2,8	3,58	3,62	3,5	2,7	2,5	1,85	1,89	2
Class A	perfectly 4,6-5	Class B	Well 3,6-4,5	Class C	satisfactorily 2,6-3,5	Class D	unsatisfactorily 1,6-2,5	Class E	badly 1-1,5									

The assessment results of the efficiency of urban open spaces have shown that the current situation of the fragments of pedestrian spaces studied in Almaty is not critical on 25% of the territory indicators characterizing the efficiency of their use. However, if we compare with the indicators of the "comparative sample" (similar European pedestrian space with a high level of effectively used territories) (Anciaes & Jones, 2020), pedestrian spaces in Almaty do not meet the requirements of the "reference." It can also be noted that the fragments, which make up 75% of the study area, require measures to improve their quality and attractiveness, especially on such indicators as the location of seating, the state of environmental and visual comfort, barrier-free environment, and others.

The main problem is the uneven distribution of infrastructure and amenities. Within the city, some neighborhoods need to be better equipped with infrastructure, such as schools, hospitals, and stores. This creates inequality in access to education, health care, and other important services for different population groups.

The loss of a city's cultural and architectural identity is a global problem (Young-Jin & Juraev, 2023). When constructing new facilities and reconstructing old ones, only economic benefits are often taken into account rather than preserving cultural and historical values. This can lead to the loss of unique architectural monuments and decrease the city's cultural wealth.

The city has congested streets and a lack of parking spaces; there are no crosswalk markings on the city streets, and curbs and sidewalk exits are present but are not in the best condition due to time and temperature differences caused by climatic conditions. Several types of fences are present, which negatively affects the formation of a unified style of the city.

In some parts of the city, small architectural objects (benches, urns, flower beds, lanterns) that create the interior of the streets are lacking; they are treated as objects of utilitarian purpose only.

Little attention is paid to the lighting design of streets, namely street lighting and architectural lighting of facades. The city pays attention to light only as a utilitarian and functional aspect to provide orientation in space; the architectural and urban planning aspect of creating the city's silhouette does not show interest (Anciaes & Jones, 2021).

Findings/Discussion

The development of algorithms for architectural design code is necessary to solve a number of problems, and optimization of the design code is necessary to ensure the competent formation of the city's structure and its further development.

The ideal solution to several problems in organizing the spatial structure of the city of Almaty is the creation of additional urban spaces, which serve as a functional basis for the dynamic environment in urban development.

In the urban environment, there is constant adaptation and renovation of space for new functions (Kamalipour & Dovey, 2020). Buildings, structures, spaces between them, and internal spaces of these volumes are being adapted. Space can be transformed with changes in its geometry, physical characteristics, and visual and figurative perception. When using transformable objects, space reorganization can occur without disturbing the existing organization of systems. That is,

it is possible to use transformable equipment as an experiment and, depending on the results, transform it into stationary or easily dismantled equipment without damage to the existing environment. Therefore, this method of creating additional urban spaces is very effective at high development rates of the architectural environment.

In the 60s and 70s, the main task in object design was to create multifunctional transformative spaces of interiors. Interesting is Joe Colombo's projects of universal modules for bedrooms, kitchens, and living rooms and the design of transformable furniture, which provided the dynamics of interior development. Gradually, these concepts began to be applied to exteriors. Designers proposed the use of transformable modules to saturate the environment. These were modules for socializing, outdoor offices, reading, and other spaces. That is, the urban space took over the functions of the interior, where there was zoning depending on human activity. It is possible to saturate the urban space using transformable universal modules with individual functions necessary for different population groups (Setyowati et al., 2013). Thus, the design of dynamic spaces at this point has evolved from object design to urban spaces. This experience is valuable for creating modern transformable systems of additional urban spaces (Jacobs, 2011).

Spaces are becoming more open, and the interior is passing into the exterior. A dynamic architectural environment is a necessary phenomenon in society's functioning and development.

There are projects on the global transformation of open spaces when a large-scale dynamic structure with the possibility of various transformations is created (Gaiduchenya, 1983). Such researchers include S. Calatrava, R. Embricks, Chuck Hoberman, and other design offices (Fig.5).

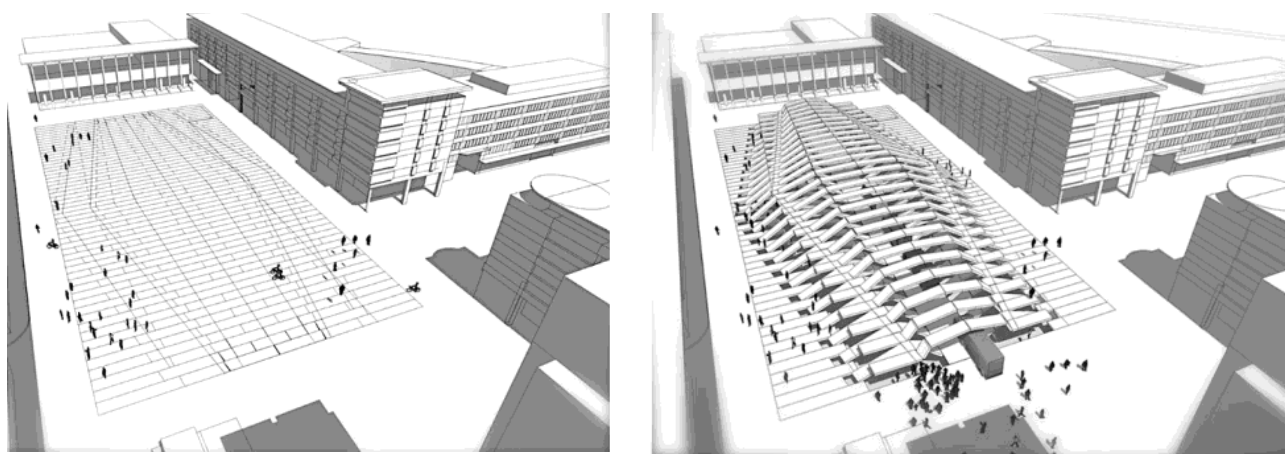


Figure 5. Design of the flexible plaza structure. R. Embricks

The use of transformable structures in the organization of additional urban spaces in Almaty will help to increase the workability of the environment (Carmona & Bento, 2023). These structures allow for the experimentation of the environment without violating its structural components. The transformable environment will solve the issue of traffic chaos on weekends through the appearance of transformable fairs on squares in each district of the city (Cui, 2021). Thus, unloading the street network and establishing pedestrian flows will favorably affect the development of small and medium-sized businesses.

In modern cities, the liveliness of urban space is a visible expression of a high concentration of diverse functions (Wilshere, 2022).

Urban population growth leads to increased pressure on urban infrastructure and resources, which makes it necessary to effectively plan and organize the spatial structure of cities (Azad & Abdelqader, 2021). One of the critical tools for achieving sustainable urban development is the architectural design code - a set of rules and guidelines that define the standards for building and developing the urban environment (Jiang et al., 2023). Its main objectives are to ensure aesthetic appeal, preserve cultural heritage, create a comfortable and safe urban environment, and ensure sustainable urban development. The architectural design code may divide the city into functional residential, industrial, commercial, and recreational zones (Jing et al., 2023). This helps to prevent the intersection of contradictory functions and create a comfortable living environment for residents.

Architectural design code has several advantages in implementation in the urban environment of Almaty:

1. Development Control.

Architectural design codes provide development control, prevent chaotic development, and preserve the unity of the city's architectural appearance (Carmona, 2023). They also avoid uneven development and disorderly infrastructure location. An essential aspect of the architectural design code is regulating building heights in different city areas. For example, historic centers can limit the height of buildings and thus preserve the color in the historic part of the city.

2. Improvement of the urban environment.

Architectural design code aims to create a quality urban environment, improving citizens' overall quality of life (Chang & Goodwin, 2022). Green areas, public spaces, pedestrian alleys, and other elements of urban infrastructure become more accessible and functional. Almaty is famous for its beautiful parks and green areas. Architectural design codes can define rules and restrictions for development near parks and other green areas to preserve their natural beauty and ecological value.

3. Balanced Development.

The design code promotes a balanced development of different city areas (Ivana Caviar, 2023). It can create cultural and commercial centers and educational and medical facilities within predetermined zones, which avoids overloading some areas and further stimulates the development of others.

4. Maintaining tradition and identity. The architectural design code considers and preserves the city's historical and cultural identity (Luo & Chiou, 2021). The preservation of architectural monuments and traditional elements in the design of new buildings and streets creates a sense of unity and attractiveness for residents and tourists (Morgun et al., 2017; Jabbari et al., 2023).

Like many other significant megacities in the world, the spatial structure of the city of Almaty faces several serious challenges that affect the quality of life of citizens and the sustainability of the urban environment. In recent decades, the city of Almaty has faced population growth and urbanization, which has led to the need for sustainable development strategies. In this context, the architectural design code plays a crucial role in organizing the city's spatial structure. It

defines standards for new constructions, reconstruction of existing buildings, and infrastructure development (Zhou & Wang, 2024).

Conclusions

The urban environment should be a comfortable and maximally adapted space, which is created taking into account a particular set of factors: the presence or absence of the historical center of the city, the formation of a competent layout of the street network, the creation of unimpeded transport accessibility, the presence of recreational and public areas, modeling clear zoning of the city, creating the necessary conditions of accessibility of objects for different categories of the population. (Potapova, 2012).

According to studies conducted in Almaty, the main problems that reduce the quality of urban environment are:

– insufficient number of greening facilities and other high-quality recreational areas;

A large amount of low-quality housing stock;

– problems of the transportation system, expressed in a large number of traffic jams and an increase in the number of areas occupied by parking lots (Boeing et al., 2024; Choi & Ewing, 2021);

– high level of air pollution, migration problems.

In the long term, applying the architectural design code in Almaty should lead to sustainable development outcomes for both the urban community and the urban economy. The normative legal definition of this design tool should be more clearly, holistically, and consistently defined in implementation.

In conclusion, the need for an architectural design code in Almaty is due to many factors. Unfortunately, the design code developed in Almaty only regulates the placement of signs and the coloristic solution of facades. However, this document should cover a much larger number of aspects related to a comfortable urban environment, which in turn will allow to meet not only the aesthetic needs of the city but also to form an infrastructure for internal and external tourists, as well as to create a favorable environment for citizens.

Conflict of interest. There is no conflict of interest between the authors.

The contribution of the authors

Almukasheva D.B. – contribution to the concept; execution of the claimed scientific research; creation of a scientific article.

Maulenova G.D. – contribution to the concept.

Nazarova D.N. – interpretation of the claimed scientific research.

References

1. Ancaes P, Jones P. (2020), Transport policy for liveability – valuing the impacts on movement, place, and society, *Journal Of Transportation Research Part A: Policy and Practice* 132(3): 157-173, <https://doi.org/10.1016/j.tra.2019.11.009>.

2. Ancaes P, Jones P. (2021), Pedestrian priority in street design - how can it improve sustainable mobility? *Journal of Transportation Research Procedia* 60(2022):220-227, <https://doi.org/10.1016/j.trpro.2021.12.029>.
3. Azad M., Abdelqader D., Taboada L.M., Cherry C.R. (2021), Walk-to-transit demand estimation methods applied at the parcel level to improve pedestrian infrastructure investment, *Journal of Transport Geography* 92(1433): 1-12, <https://doi.org/10.1016/j.jtrangeo.2021.103019>.
4. Boeing G., Pilgram C., Lu Y. (2024), Urban street network design and transport-related greenhouse gas emissions around the world, *Journal Of Transportation Research Part D: Transport and Environment*, 127(21): 2-23, <https://doi.org/10.2139/ssrn.4682232>.
5. Caniggia G., Maffei G.L. (2001), *Architectural composition and building typology: interpreting basic building*, Siena, Alinea Editrice.
6. Carmona M., Bento J., Gabrieli T. (2023), *Urban Design Governance: Soft Powers and the European Experience*, London, UK.
7. Carmona M. (2023), Coding design: Constructing a wireframe for a place-focused urbanism, *Journal of Progress in planning* 176(20): 1-40, <https://doi.org/10.1016/j.progress.2023.100775>.
8. Chang M., Goodwin H., Burbridge A. (2022), Re-imagining the use of design codes – designing healthier and more equitable places, *Journal Of Town & Country Planning* 91(5):306-312, <https://doi.org/10.1016/j.progress.2023.100775>.
9. Choi D., Ewing R. (2021), Effect of street network design on traffic congestion and traffic safety, *Journal Of Transport Geography* 96(2): 139-151, <https://doi.org/10.1016/j.jtrangeo.2021.103200>.
10. Cui J. (2021), Building three-dimensional pedestrian networks in cities, *Journal Of Underground Space* 6(2):217-224, <https://doi.org/10.1016/j.undsp.2020.02.008>.
11. Gaiduchenya A.A. (1983), *Dynamic Architecture (main directions of development, principles, methods)*, Budilnik, Moscow, Russia.
12. Gutnov A.E. (1984), *Evolution of Urban Planning*, Stroyizdat, Moscow, Russia.
13. Ivana Cavar S. (2023), *Smart urban mobility*, Elsevier Science, Ghent, Belgium.
14. Jabbari M., Fonseca F., Smith G., Conticelli E., Tondelli S., Ribeiro P., Ahmadi Z., Papageorgiou G., Ramos R. (2023), The Pedestrian Network Concept: A Systematic Literature Review, *Journal of Urban Mobility* 3(3): 36-48, <https://doi.org/10.1016/j.urbmob.2023.100051>.
15. Jacobs D. (2011), *Death and Life of Big American Cities*, New Publishing House, Moscow, Russia.
16. Jiang F., Ma J., Webster C.J., Chiaradia Alain J.F., Zhou Y., Zhao Z., Zhang X. (2023), Generative urban design: A systematic review on problem formulation, design generation, and decision-making, *Journal of Progress in Planning* 180(1-35):100795, <https://doi.org/10.1016/j.progress.2023.100795>.
17. Jing J., Zlatanova S., Liu H., Aleksandrov M., Zhang K. (2023), A design-support framework to assess urban green spaces for human wellbeing, *Journal of Sustainable Cities a Society* 98:104779, <https://doi.org/10.1016/j.scs.2023.104779>.
18. Kamalipour H., Dovey K. (2020), Incremental production of urban space: A typology of informal design, *Journal of Habitat International* 98(2):102-133, <https://doi.org/10.1016/j.habitat-int.2020.102133>.
19. Levy A. (1999), Urban Morphology and the Problem of the Modern Urban Fabric: Some Questions for Research, *Journal of Urban Morphology* 2(3): 79-85, <https://doi.org/10.51347/jum.v3i2.3885>.

20. Luo H., Chiou B.S. (2021), Framing the Hierarchy of Cultural Tourism Attractiveness of Chinese Historic Districts under the Premise of Landscape Conservation, *Journal of Land* 10(2): 216, <https://doi.org/10.3390/land10020216>.

21. Maretto M. (2014), Sustainable urbanism: The role of urban morphology, *Journal of Urban morphology* 18(2): 163-164, <https://doi.org/10.51347/jum.v18i2.4578>.

22. Morgun N.A., Reznitskaya L.M., Skopintsev A.V. (2013), Architectural scenography of the urban environment - as a design strategy for the reconstruction of the historic city center and a factor in strengthening its tourist image, report at the congress of the inter-district association of the Southern Architectural Society of the Union of Architects of Russia, *Journal of World Applied Sciences* 26(8): 1019-1026.

23. Moughtin C. (2003), *Urban design: street and square*. Third edition, Oxford: Architectural Press, Elsevier, Oxford, UK.

24. Inglis N. C., Vukomanovic J., Costanza J., Singh K. (2022), From viewsheds to viewsapes: Trends in landscape visibility and visual quality research, *Journal of Landscape and Urban Planning* 224 (3): 1-12, <https://doi.org/10.1016/j.landurbplan.2022.104424>.

25. Oliveira V. (2021), *Morphological Research in Planning, Urban Design and Architecture*, Springer International Publishing, Cham, Switzerland.

26. Potaev G.A. (2014), *Composition in Architecture and Urban Planning*, INFRA-M, Moscow, Russia.

27. Potapova A.V. (2012), Methods of regeneration of historical neighborhoods in modern European practice on the example of Neu-Stadt district (Dresden, Germany), *Journal of AMIT* 2(19): 1-17.

28. Selby C., Robbie N., Mark R. (2019), *Urban mobility design*, Melbourne, VIC, Australia.

29. Setyowati E., Rochma Harani A., Nurul Falah Y. (2013), The Application of Pedestrian Ways Design Concepts as an Implementation of Sustainable Urban Open Spaces, *Journal of Procedia - Social and Behavioral Sciences* 85(1):345-355, <https://doi.org/10.1016/j.sbspro.2013.08.364>.

30. Wilshere M. (2022), Design codes, *Journal of Urban Design* 163(2): 7-13.

31. Yang L., Li J., Chang H.-T., Zhao Z., Ma H., Zhou L. (2023), A Generative Urban Space Design Method Based on Shape Grammar and Urban Induction Patterns, *Journal of Land* 12(6): 1-21, <https://doi.org/10.3390/land12061167>.

32. Yang L., Chang H.-T., Ma H., Wang T., Xu J., Chen J. (2023), Applying Evolutionary Computation to Optimize the Design of Urban Blocks, *Journal of Buildings* 13(3):755, <https://doi.org/10.3390/buildings13030755>.

33. Yan W., Meng Q., Yang D., Li M. (2024), Developing a theory of tranquility in urban public open spaces for future designs, *Journal of Applied Acoustics* 217: 109824, <https://doi.org/10.1016/j.apacoust.2023.109824>.

34. Young-Jin A., Juraev Z. (2023), Green spaces in Uzbekistan: Historical heritage and challenges for urban environment, *Journal of Nature-Based Solutions* 4(8):401-413, <https://doi.org/10.1016/j.nbsj.2023.100077>.

35. Yoshiki Y., Perry P.J. Yang. (2020), *Urban systems design*, Ibaraki, Japan.

35. Zhou M., Wang F. (2024), The driving factors of recreational utilization of ecological space in urban agglomerations: The perspective of urban political ecology, *Journal of Ecological Indicators* 158(2024): 598-604, <https://doi.org/10.1016/j.ecolind.2023.111409>.

Д.Б.Альмукашева^{*1}, Г.Д.Мауленова¹, Д.А.Назарова²

¹*Қ.И.Сәтбаев атындағы Қазақ ұлттық зерттеу техникалық университеті, Алматы, Қазақстан*

²*Ташкент сәулет-құрылыс университеті, қала құрылысы және ландшафттық сәулет кафедрасы, Ташкент, Өзбекстан*

Алматы қаласының мысалында сәулеттік дизайн- коды негізінде қалалардың кеңістіктік құрылымын ұйымдастыру

Андатпа. Бұл мақалада қалалардың кеңістіктік құрылымын ұйымдастыру және бұл мәселені Алматы қаласы сияқты сәулеттік дизайн кодтарының көмегімен шешу мәселесі қарастырылады. Үйлесімді қалалық ортаны құрудың принциптері мен жобалау тәсілдерін жарықтандыру, алгоритмдерді әзірлеу, сәулеттік жобалау кодтарын енгізу мәселелері Алматы қаласының мысалындағыдай сәулет-қала құрылысы ортасын ұйымдастыру мәселелерін ұсынады.. Мақала Қазақстанның маңызды экономикалық және мәдени орталығы Алматыда жүргізілген зерттеулерге негізделген. Мақалада қалалық ортаны жоспарлау мен дамытудағы қиындықтарды жеңу құралы ретінде сәулеттік дизайн кодексіне негізделген тәсіл ұсынылған. Мақалада қалалық орта үшін сәулеттік дизайн кодтарын әзірлеудің негізгі принциптері қарастырылған. Қала үшін бірегей бірегейлікті қалыптастыруға, қала кеңістігінің тұрақтылығы мен қол жетімділігін қамтамасыз етуге, қазіргі заман мен мәдени мұраны сақтау арасындағы тепе-теңдікті құруға ерекше көңіл бөлінеді.

Түйін сөздер: сәулеттік дизайн коды, жаяу жүргіншілер кеңістігі, көшелер, қалалық орта, қала құрылысы.

Д.Б.Альмукашева¹, Г.Д.Мауленова¹, Д.А.Назарова²

¹*Казахский национальный исследовательский технический университет имени К.И. Сатбаева, Алматы, Казахстан*

²*Ташкентский архитектурно-строительный университет, кафедра градостроительства и ландшафтной архитектуры, Ташкент, Узбекистан*

Организация пространственной структуры городов на основе архитектурного дизайн-кода на примере города алматы

Аннотация. В данной статье исследуется проблема организации пространственной структуры городов и решения этой проблемы с помощью архитектурных дизайн-кодов, таких как город Алматы. Вопросы освещения принципов и проектных подходов для создания гармоничной городской среды, разработки алгоритмов и внедрения архитектурных дизайн-кодов представляют проблемы организации архитектурной и градостроительной среды, как на примере города Алматы. Статья основана на исследованиях, проведенных в Алматы, важном экономическом и культурном центре Казахстана. В статье представлен подход, основанный на архитектурном дизайн-коде, как инструменте преодоления трудностей в планировании и развитии городской среды. В статье рассматриваются основные принципы разработки

архитектурных дизайн-кодов для городской среды. Особое внимание уделяется созданию уникальной идентичности города, обеспечению устойчивости и доступности городских пространств, а также созданию баланса между современностью и сохранением культурного наследия.

Ключевые слова: архитектурный дизайн-код, пешеходное пространство, улицы, городская среда, градостроительство.

References

1. Ancaes P., Jones P. (2020), Transport policy for liveability – valuing the impacts on movement, place, and society, *Journal Of Transportation Research Part A: Policy and Practice* 132(3): 157-173, <https://doi.org/10.1016/j.tra.2019.11.009>.
2. Ancaes P., Jones P. (2021), Pedestrian priority in street design - how can it improve sustainable mobility? *Journal of Transportation Research Procedia* 60(2022):220-227, <https://doi.org/10.1016/j.trpro.2021.12.029>.
3. Azad M., Abdelqader D., Taboada L.M., Cherry C.R. (2021), Walk-to-transit demand estimation methods applied at the parcel level to improve pedestrian infrastructure investment, *Journal of Transport Geography* 92(1433): 1-12, <https://doi.org/10.1016/j.jtrangeo.2021.103019>.
4. Boeing G., Pilgram C., Lu Y. (2024), Urban street network design and transport-related greenhouse gas emissions around the world, *Journal Of Transportation Research Part D: Transport and Environment*, 127(21): 2-23, <https://doi.org/10.2139/ssrn.4682232>.
5. Caniggia G., Maffei G.L. (2001), *Architectural composition and building typology: interpreting basic building*, Siena, Alinea Editrice.
6. Carmona M., Bento J., Gabrieli T. (2023), *Urban Design Governance: Soft Powers and the European Experience*, London, UK.
7. Carmona M. (2023), Coding design: Constructing a wireframe for a place-focused urbanism, *Journal of Progress in planning* 176(20): 1-40, <https://doi.org/10.1016/j.progress.2023.100775>.
8. Chang M., Goodwin H., Burbridge A. (2022), Re-imagining the use of design codes – designing healthier and more equitable places, *Journal Of Town & Country Planning* 91(5):306-312, <https://doi.org/10.1016/j.progress.2023.100775>.
9. Choi D., Ewing R. (2021), Effect of street network design on traffic congestion and traffic safety, *Journal Of Transport Geography* 96(2): 139-151, <https://doi.org/10.1016/j.jtrangeo.2021.103200>.
10. Cui J. (2021), Building three-dimensional pedestrian networks in cities, *Journal Of Underground Space* 6(2):217-224, <https://doi.org/10.1016/j.undsp.2020.02.008>.
11. Gaiduchenya A.A. (1983), *Dynamic Architecture (main directions of development, principles, methods)*, Budilnik, Moscow, Russia.
12. Gutnov A.E. (1984), *Evolution of Urban Planning*, Stroyizdat, Moscow, Russia.
13. Ivana Cavar S. (2023), *Smart urban mobility*, Elsevier Science, Ghent, Belgium.
14. Jabbari M., Fonseca F., Smith G., Conticelli E., Tondelli S., Ribeiro P., Ahmadi Z., Papageorgiou G., Ramos R. (2023), The Pedestrian Network Concept: A Systematic Literature Review, *Journal of Urban Mobility* 3(3): 36-48, <https://doi.org/10.1016/j.urbmob.2023.100051>.
15. Jacobs D. (2011), *Death and Life of Big American Cities*, New Publishing House, Moscow, Russia.

16. Jiang F., Ma J., Webster C.J., Chiaradia Alain J.F., Zhou Y., Zhao Z., Zhang X. (2023), Generative urban design: A systematic review on problem formulation, design generation, and decision-making, *Journal of Progress in Planning* 180(1-35):100795, <https://doi.org/10.1016/j.progress.2023.100795>.
17. Jing J., Zlatanova S., Liu H., Aleksandrov M., Zhang K. (2023), A design-support framework to assess urban green spaces for human wellbeing, *Journal of Sustainable Cities a Society* 98:104779, <https://doi.org/10.1016/j.scs.2023.104779>.
18. Kamalipour H., Dovey K. (2020), Incremental production of urban space: A typology of informal design, *Journal of Habitat International* 98(2):102-133, <https://doi.org/10.1016/j.habitatint.2020.102133>.
19. Levy A. (1999), Urban Morphology and the Problem of the Modern Urban Fabric: Some Questions for Research, *Journal of Urban Morphology* 2(3): 79-85, <https://doi.org/10.51347/jum.v3i2.3885>.
20. Luo H., Chiou B.S. (2021), Framing the Hierarchy of Cultural Tourism Attractiveness of Chinese Historic Districts under the Premise of Landscape Conservation, *Journal of Land* 10(2): 216, <https://doi.org/10.3390/land10020216>.
21. Maretto M. (2014), Sustainable urbanism: The role of urban morphology, *Journal of Urban morphology* 18(2): 163-164, <https://doi.org/10.51347/jum.v18i2.4578>.
22. Morgun N.A., Reznitskaya L.M., Skopintsev A.V. (2013), Architectural scenography of the urban environment - as a design strategy for the reconstruction of the historic city center and a factor in strengthening its tourist image, report at the congress of the inter-district association of the Southern Architectural Society of the Union of Architects of Russia, *Journal of World Applied Sciences* 26(8): 1019-1026.
23. Moughtin C. (2003), *Urban design: street and square*. Third edition, Oxford: Architectural Press, Elsevier, Oxford, UK.
24. Inglis N. C., Vukomanovic J., Costanza J., Singh K. (2022), From viewsheds to viewscales: Trends in landscape visibility and visual quality research, *Journal of Landscape and Urban Planning* 224 (3): 1-12, <https://doi.org/10.1016/j.landurbplan.2022.104424>.
25. Oliveira V. (2021), *Morphological Research in Planning, Urban Design and Architecture*, Springer International Publishing, Cham, Switzerland.
26. Potaev G.A. (2014), *Composition in Architecture and Urban Planning*, INFRA-M, Moscow, Russia.
27. Potapova A.V. (2012), Methods of regeneration of historical neighborhoods in modern European practice on the example of Neu-Stadt district (Dresden, Germany), *Journal of AMIT* 2(19): 1-17.
28. Selby C., Robbie N., Mark R. (2019), *Urban mobility design*, Melbourne, VIC, Australia.
29. Setyowati E., Rochma Harani A., Nurul Falah Y. (2013), The Application of Pedestrian Ways Design Concepts as an Implementation of Sustainable Urban Open Spaces, *Journal of Procedia - Social and Behavioral Sciences* 85(1):345-355, <https://doi.org/10.1016/j.sbspro.2013.08.364>.
30. Wilshere M. (2022), Design codes, *Journal of Urban Design* 163(2): 7-13.
31. Yang L., Li J., Chang H.-T., Zhao Z., Ma H., Zhou L. (2023), A Generative Urban Space Design Method Based on Shape Grammar and Urban Induction Patterns, *Journal of Land* 12(6): 1-21, <https://doi.org/10.3390/land12061167>.
32. Yang L., Chang H.-T., Ma H., Wang T., Xu J., Chen J. (2023), Applying Evolutionary Computation to Optimize the Design of Urban Blocks, *Journal of Buildings* 13(3):755, <https://doi.org/10.3390/buildings13030755>.

33. Yan W., Meng Q., Yang D., Li M. (2024), Developing a theory of tranquility in urban public open spaces for future designs, *Journal of Applied Acoustics* 217: 109824, <https://doi.org/10.1016/j.apacoust.2023.109824>.

34. Young-Jin A., Juraev Z. (2023), Green spaces in Uzbekistan: Historical heritage and challenges for urban environment, *Journal of Nature-Based Solutions* 4(8):401-413, <https://doi.org/10.1016/j.nbsj.2023.100077>.

35. Yoshiki Y., Perry P.J., Yang. (2020), Urban systems design, Ibaraki, Japan.

35. Zhou M., Wang F. (2024), The driving factors of recreational utilization of ecological space in urban agglomerations: The perspective of urban political ecology, *Journal of Ecological Indicators* 158(2024): 598-604, <https://doi.org/10.1016/j.ecolind.2023.111409>.

Information about the authors:

Almukasheva Dina Bukenbaevna – post doctoral student of the Department of Architecture, K. I. Satpayev Kazakh National Research Technical University, Almaty, Kazakhstan.

Maulenova Gulnara Dzhuparbekovna – professor of the Department of Architecture, Kazakh National Technical University named after K. Satpayev, Almaty, Kazakhstan.

Nazarova Dinara Anvarovna – professor, Department of Urban Planning and Landscape Architecture, Tashkent Architecture and Construction University, Tashkent, Uzbekistan.

Альмукашева Д.Б. – «Сәулет» кафедрасының пост-докторанты, Қ.И.Сәтбаев атындағы Қазақ ұлттық зерттеу техникалық университеті, 050013, Алматы, Қазақстан. E-mail: d.almukasheva@cu.edu.kz

Мауленова Г.Д. – «Сәулет» кафедрасының профессоры, Қ.И.Сәтбаев атындағы Қазақ ұлттық зерттеу техникалық университеті, 050013, Алматы, Қазақстан.

Назарова Д.А. – Ташкент сәулет-құрылыс университеті, қала құрылысы және ландшафтық сәулет кафедрасы, Ташкент, Өзбекстан.

Альмукашева Д.Б. – пост-докторант кафедрасы «Архитектура», Казахский национальный исследовательский технический университет им. К. И. Сатпаева, 050013, г. Алматы, Казахстан.

E-mail: d.almukasheva@cu.edu.kz

Мауленова Г.Д. - профессор кафедрасы «Архитектура», Казахский национальный технический университет им. К. Сатпаева, 050013, Алматы, Казахстан.

Назарова Д.А. - профессор кафедрасы градостроительства и ландшафтной архитектуры Ташкентского архитектурно-строительного университета, Ташкент, Узбекистан.



Copyright: © 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY NC) license (<https://creativecommons.org/licenses/by-nc/4.0/>).