

Written Review by the Official Reviewer

on the dissertation of doctoral candidate Saya Meirkhanovna Sakenova
on the topic: “Specific Features of the Development of Bioclimatic Architecture for Low-Rise Urban Housing in Southeastern Kazakhstan”, submitted for the degree of Doctor of Philosophy (PhD)
under the educational program 8D07311 - “Architecture”

No.	Criteria	Compliance with criteria (one of the answer options must be selected)	Justification of the official reviewer’s position
1.	The topic of the dissertation (as of the date of its approval) corresponds to the directions of scientific development and/or state programs	1.1 Compliance with priority directions of scientific development or state programs: 1) The dissertation was carried out within the framework of a project or target program funded from the state budget; 2) The dissertation was carried out within the framework of another state program; <u>3) the dissertation corresponds to a priority direction of scientific development approved by the Higher Scientific and Technical Commission under the Government of the Republic of Kazakhstan.</u>	The dissertation corresponds to the priority direction of scientific development “Intellectual Potential of the Country” and to the specialized scientific field “Architecture and Construction”. The research addresses contemporary challenges of sustainable urban development, with particular emphasis on enhancing the energy efficiency of residential buildings, adapting architectural and planning solutions to local natural and climatic conditions, and creating a comfortable and sustainable living environment in Southeastern Kazakhstan.
2.	Importance for science	Selected option: the work makes a significant contribution to science, and its importance is well disclosed.	The scientific significance of this research lies in its examination of the bioclimatic adaptation of low-rise urban housing within the specific environmental and urban contexts of cities in Southeastern Kazakhstan, rather than through a purely theoretical or generalised perspective. The dissertation provides a systematic analysis of how key factors—including topography, wind patterns, solar exposure, building density, green infrastructure, and site spatial organisation—influence the selection and application of architectural and

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			planning solutions. By establishing these relationships, the study contributes to the advancement of architectural theory while also providing practical guidance for designing climate-responsive, energy-efficient, and comfortable residential environments.
3.	Principle of independence	Level of independence: 1) high; 2) medium; 3) low; 4) no independence demonstrated.	The author's level of independence is assessed as high. The applicant independently developed the research framework, collected and systematised empirical data for three cities, conducted a comparative analysis of different types of low-rise residential environments, and formulated architectural solutions tailored to specific microclimatic conditions. A high degree of independence is further demonstrated through the development of an original methodological model that integrates site analysis, the classification of microclimatic conditions, and the corresponding architectural and planning responses. This model provides a coherent framework for adapting low-rise housing to local environmental and climatic contexts.
4.	Principle of internal coherence	4.1 Justification of the relevance of the dissertation: 1) justified; 2) partially justified; 3) not justified.	The relevance of the dissertation is convincingly justified by current challenges in architectural design and urban development. The growing demand for low-rise residential construction and sustainable housing solutions requires a transition from the application of uniform climatic standards toward design approaches that account for the specific natural and environmental characteristics of individual locations. This need is particularly evident in the cities of Almaty, Konaev, and Taldykorgan, where pronounced differences in topography, climatic conditions, and urban structure directly affect the quality and performance of the residential environment. The research, therefore, addresses an important scientific and practical problem and demonstrates the necessity of developing differentiated architectural and planning solutions adapted to local microclimatic conditions.
4.	Principle of internal coherence	4.2 The content of the dissertation reflects the topic of the dissertation: 1) reflects; 2) partially reflects; 3) does not reflect.	The content of the work corresponds to the topic. The dissertation reveals the theoretical foundations of bioclimatic architecture, analyses the climatic and urban-planning prerequisites for the formation of low-rise housing, identifies microclimatic types of sites, and proposes design solutions. The internal logic of the research can be traced from the analysis of factors to practical

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			recommendations.
4.	Principle of internal coherence	4.3 The aim and objectives correspond to the topic of the dissertation: 1) correspond; 2) partially correspond; 3) do not correspond.	The aim of the dissertation and the research objectives are fully consistent with the stated topic and collectively provide a coherent framework for addressing the scientific problem under investigation. They are focused on examining the principles of bioclimatic architecture for low-rise urban housing, analysing the natural-climatic and urban-planning conditions of the study area, identifying patterns of microclimatic variation within the urban environment, and substantiating differentiated architectural and planning recommendations. The logical relationship between the aim and the objectives ensures a systematic investigation of the research problem and facilitates the achievement of scientifically grounded results.
4.	Principle of internal coherence	4.4 All sections and provisions of the dissertation are logically interconnected: 1) fully interconnected; 2) partially interconnected; 3) no interconnection.	The dissertation demonstrates a coherent and logically structured organisation. The theoretical foundations established in the first section provide the methodological basis for the analysis of natural-climatic and urban-planning factors, as well as regional architectural experience, presented in the second section. Building upon this analysis, the study develops a methodology for the microclimatic differentiation of the urban environment and formulates the author's model of differentiated architectural design. The findings and conclusions of each section are logically interconnected, consistently support one another, and contribute to the achievement of the overall aim of the dissertation research.
4.	Principle of internal coherence	4.5 The new solutions proposed by the author (principles, methods) are substantiated and evaluated in comparison with known solutions: 1) critical analysis is provided; 2) analysis is partial; 3) the analysis represents not the author's own opinions, but quotations from other authors.	The originality and validity of the author's proposed solutions are substantiated through their comparison with established principles of bioclimatic, energy-efficient, and climate-responsive architectural design. A notable strength of the dissertation lies in its context-specific approach: rather than merely cataloguing conventional passive design strategies, the author systematically relates these strategies to the particular environmental and urban conditions of a site. Factors such as wind exposure, solar access, natural ventilation potential, topography, green infrastructure, and urban morphology are analysed as determinants of architectural and planning decisions. This approach enables the development of differentiated design solutions that are responsive to local microclimatic

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			conditions and regional characteristics.
5.	Principle of scientific novelty	5.1 Are the results and provisions new? 1) completely new; 2) partially new (25-75% are new); 3) not new.	The scientific novelty of the dissertation lies in the systematic identification, classification, and integration of the factors influencing the development of bioclimatic architecture for low-rise urban housing in Southeastern Kazakhstan. A key original contribution of the research is the establishment of microclimatic differentiation of the urban environment as a methodological framework for architectural and planning decision-making. The dissertation further introduces an author-developed model that links the analysis of natural-climatic and urban-planning conditions with the formulation of differentiated architectural responses adapted to specific site characteristics. While the study builds upon established theoretical foundations of bioclimatic architecture, it advances this body of knowledge by adapting and applying these principles to the environmental, climatic, and urban conditions of the region, thereby extending their practical relevance and methodological applicability.
5.	Principle of scientific novelty	5.2 Are the conclusions of the dissertation new? 1) completely new; 2) partially new (25-75% are new); 3) not new.	The dissertation conclusions demonstrate scientific novelty by substantiating the relationship between architectural and planning solutions for low-rise housing and the specific microclimatic conditions of the urban environment. Among the original findings is the identification of differentiated design approaches for sites characterised by varying microclimatic conditions, including wind-exposed areas, moderately protected zones, locations with restricted natural ventilation, and sites whose environmental performance is significantly influenced by topography and landscape structure. These conclusions provide a basis for the development of context-sensitive architectural solutions that respond more effectively to local climatic and spatial characteristics.
5.	Principle of scientific novelty	5.3 Are the technical, technological, economic, or managerial solutions new and substantiated: 1) completely new; 2) partially new (25-75% are new);	The solutions presented by the author are characterized by novelty primarily in practical and methodological terms. The work systematizes design techniques by identifying planning, volumetric-spatial, architectural and structural, solar and daylighting, aeration, and microclimatic groups. Of particular significance is the correlation of these techniques with different types of microclimatic zones, which increases the applied value of the research and allows its results to be used at the stages of pre-design analysis and architectural design.

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		3) not new.	
6.	Validity of the main conclusions	All main conclusions are based on scientifically significant evidence and are sufficiently well substantiated.	The conclusions of the dissertation are sufficiently substantiated. They are based on a comparison of the climatic and urban-planning conditions of the three cities, analysis of the morphology of low-rise development, systematization of architectural techniques, and the author's graphical-analytical interpretation of microclimatic differences. The presented conclusions logically follow from the collected material and correspond to the stated methodology.
7.	Main provisions submitted for defense	<p>It is necessary to answer the following questions for each provision separately:</p> <p>Provision 1. 7.1 Has the provision been proven? 1) proven; 2) rather proven; 3) rather not proven; 4) not proven 7.2 Is it trivial? 1) yes; 2) no. 7.3 Is it new? 1) yes; 2) no. 7.4 Scope of application: 1) narrow; 2) medium; 3) wide. 7.5 Is it proven in an article? 1) yes; 2) no.</p> <p>Provision 2. 7.1 Has the provision been proven? 5) proven;</p>	<p>Provision 1. The need for microclimatic differentiation as a basis for the development of bioclimatic low-rise housing.</p> <p>Provision 2. The factor structure of site analysis: natural-climatic, territorial and landscape, urban-planning, and architectural-planning parameters.</p> <p>Provision 3. The author's model and system of differentiated solutions for zone-oriented design.</p> <p>The provisions submitted for defense have been proven within the framework of the completed research. They are not trivial, since they are aimed at clarifying the design methodology for specific urban and climatic conditions. The scope of application of the results can be assessed as medium and wide: they are applicable in the educational process, pre-design analysis, and the practice of developing recommendations for low-rise residential development.</p>

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		<p>6) rather proven; 7) rather not proven; 8) not proven 7.2 Is it trivial? 1) yes; 2) no. 7.3 Is it new? 1) yes; 2) no. 7.4 Scope of application: 4) narrow; 5) medium; 6) wide. 7.5 Is it proven in an article? 1) yes; 2) no.</p> <p>Provision 3. 7.1 Has the provision been proven? 9) proven; 10) rather proven; 11) rather not proven; 12) not proven 7.2 Is it trivial? 1) yes; 2) no. 7.3 Is it new? 1) yes; 2) no. 7.4 Scope of application: 7) narrow; 8) medium; 9) wide. 7.5 Is it proven in an article? 1) yes; 2) no.</p>	
8.	Principle of reliability.	8.1 The choice of methodology is justified or the methodology is	The choice of methodology is justified. To solve the stated objectives, the author uses a set of methods: analysis of theoretical sources, comparative study of


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	Reliability of sources and information provided	described in sufficient detail: <u>1) yes;</u> 2) no.	design experience, graphical-analytical consideration of climatic and spatial data, classification of microclimatic situations, and systematization of architectural solutions. The methodological apparatus corresponds to the nature of a dissertation in architecture.
8.	Principle of reliability. Reliability of sources and information provided	8.2 The results of the dissertation work were obtained using modern methods of scientific research and methods for processing and interpreting data using computer technologies: <u>1) yes;</u> 2) no.	The work uses modern methods for interpreting architectural and urban-planning information: processing of climatic data, cartographic base materials, comparative tables, factor diagrams, typological matrices, and the author's graphic models. These tools make it possible not only to describe, but also to structure the conditions for the development of bioclimatic housing.
8.	Principle of reliability. Reliability of sources and information provided	8.3 Theoretical conclusions, models, identified relationships and regularities have been proven and confirmed by the research: <u>1) yes;</u> 2) no.	The theoretical propositions, conclusions, and identified relationships are supported by comparative, typological, and graphical-analytical methods of analysis. Given the nature of architectural research, which is primarily focused on theoretical development and methodological substantiation, the level of evidence and argumentation presented in the dissertation can be considered adequate and well-founded. The author consistently demonstrates the interrelationship between the microclimatic characteristics of the urban environment, patterns of urban morphology, and the selection of architectural and planning strategies for low-rise residential development. This analytical framework provides a coherent basis for the formulation of context-sensitive design recommendations.
8.	Principle of reliability. Reliability of sources and information provided	8.4 Important statements are confirmed by references to relevant and reliable scientific literature: <u>confirmed.</u>	The key provisions of the dissertation research are substantiated by references to relevant domestic and foreign scientific sources devoted to bioclimatic architecture, sustainable housing construction, climate-adaptive design, energy efficiency, and urban-planning analysis. The source base used makes it possible to characterize the degree of development of the research problem sufficiently fully and to determine the place of this dissertation in contemporary scientific discourse.

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8.	Principle of reliability. Reliability of sources and information provided	8.5 The sources used are sufficient/insufficient for the literature review: <u>sufficient.</u>	The source base used is sufficient to disclose the stated topic of the dissertation. The literature review includes the main research areas related to the theory of bioclimatic architecture, sustainable development of the urban environment, climate-adaptive design, the specificity of low-rise housing, regional features of architecture in Kazakhstan, as well as methods for studying and assessing microclimatic conditions.
9.	Principle of practical value	9.1 The dissertation has theoretical significance: <u>1) yes;</u> 2) no.	The theoretical significance of the dissertation lies in the development of ideas about low-rise urban housing as a system that responds to local climatic and urban-planning conditions. The work clarifies the relationship between the microclimate of a site and architectural form, planning structure, orientation, building depth, buffer spaces, aeration, and green spaces.
9.	Principle of practical value	9.2 The dissertation has practical significance and there is a high probability that the obtained results will be applied in practice: <u>1) yes;</u> 2) no.	The practical significance of the work is expressed quite clearly. The results can be used by architects and design organizations when selecting the orientation of residential blocks, forming courtyard spaces, applying buffer elements, developing facade solutions, organizing protection against overheating, and ensuring natural ventilation. The principle of linking these solutions to a specific type of microclimatic zone is especially valuable.
9.	Principle of practical value	9.3 Are the proposals for practice new? 1) completely new; <u>2) partially new (25-75% are new);</u> 3) not new.	The proposals for practice are partially new and practically significant. Their novelty consists in the regional adaptation of known bioclimatic design techniques and their integration into a unified system of solutions for low-rise housing. The practical result is that the designer receives not a general set of recommendations, but a differentiated tool for different site conditions.
10.	Quality of writing and formatting	Quality of academic writing: <u>1) high;</u> 2) medium;	The level of academic writing in the dissertation can be assessed as high. The material is presented in a consistent scientific style, the structure of the research is logically sequenced, and the main provisions are presented clearly and in a

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		3) below average; 4) low.	well-argued manner. The illustrative materials, diagrams, tables, and author's models used meaningfully complement the dissertation text and contribute to a fuller disclosure of the stated topic.
11.	Comments on the dissertation	Reviewer's comments.	<p>1. To enhance the practical applicability of the research findings, the dissertation could be supplemented with a concise implementation framework or checklist intended for use by design organisations and urban-planning authorities when applying the proposed recommendations.</p> <p>2. The discussion of certain architectural and planning solutions could be further strengthened by including brief considerations regarding their structural feasibility and economic efficiency in the context of large-scale low-rise residential development.</p> <p>These observations are intended as recommendations for further refinement of the work and do not detract from its scientific novelty, theoretical significance, or practical value. Overall, they do not affect the positive assessment of the dissertation or the validity of its main conclusions.</p>
12.	Scientific level of the doctoral candidate's articles on the research topic	Assessment of the scientific level of publications.	The applicant's published works correspond to the topic of the dissertation and reflect the main research results: the factors shaping the bioclimatic microclimate of a building, the microclimatic differentiation of low-rise housing, the potential of sustainable and intelligent technologies, and the development of residential architecture in Kazakhstan. The article "Conformation Factors of Building Bioclimatic Microclimate" in Civil Engineering and Architecture demonstrates a sufficient international level of approbation of the results. The publication in the QazBSQA Bulletin directly addresses the issue of microclimatic differentiation, which confirms the connection between the applicant's publication activity and the content of the dissertation.
13.	Decision of the official reviewer	Final decision.	The dissertation of Saya Meirkhanovna Sakenova on the topic "Specific Features of the Development of Bioclimatic Architecture for Low-Rise Urban Housing in Southeastern Kazakhstan", submitted for the degree of Doctor of Philosophy (PhD) under the educational program 8D07311 - "Architecture",

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			meets the established requirements for dissertations submitted for the degree of Doctor of Philosophy (PhD). Based on the above, I consider it possible to petition the Committee to award Saya Meirkhanovna Sakenova the degree of Doctor of Philosophy (PhD) under the educational program 8D07311 - "Architecture".

Official Reviewer
 PhD, Chief Architect and Deputy Director
 AS Engineering LLP


 _____ A.E. Kozhakhmetov

"15"  2026

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