THE STUDY OF TYPOLOGICAL AND COMPOSITIONAL SOLUTIONS OF RESORT AND HEALTH REHABILITATION COMPLEXES IN DESERT AND SEMI-DESERT AREAS: ANALYSIS OF THE CURRENT STATE AND DEVELOPMENT TRENDS

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Abstract: *This study examines the typological and compositional solutions of resort and health rehabilitation complexes located in desert and semi-desert regions. The research aims to identify the current state of architectural approaches and to evaluate development trends under extreme climatic conditions. The study integrates climatic, environmental, and functional planning factors, highlighting the importance of adaptation to arid landscapes. The findings reveal that modern architectural solutions increasingly rely on climate-responsive design, compact planning structures, and the integration of natural therapeutic resources. The study contributes to the development of sustainable architectural models for rehabilitation complexes in arid environments.*

Keywords: *desert architecture, semi-desert regions, resort complexes, rehabilitation facilities, typology, compositional design, climate-responsive architecture*

Аннотация: *Данное исследование посвящено анализу типологических и композиционных решений курортно-реабилитационных комплексов, расположенных в пустынных и полупустынных районах. Основной целью работы является выявление современного состояния архитектурных подходов и определение тенденций их развития в условиях резко континентального климата. В исследовании учитываются климатические, экологические и функционально-планировочные факторы, оказывающие существенное влияние на формирование архитектурной среды. Особое*

внимание уделяется адаптации зданий к экстремальным природным условиям, включая высокие температурные колебания, интенсивную солнечную радиацию и дефицит водных ресурсов. Результаты анализа показывают, что современные архитектурные решения ориентированы на использование принципов климатически адаптивного проектирования, компактной пространственной организации и интеграции природных лечебных ресурсов. Также выявлена тенденция перехода от традиционных массивных структур к более гибким и устойчивым архитектурным моделям. Полученные выводы могут служить теоретической и практической основой для проектирования современных курортно-реабилитационных комплексов в аридных регионах.

Ключевые слова: *пустынная архитектура, полупустынные регионы, курортные комплексы, реабилитационные объекты, типология, композиционные решения, климатически адаптивное проектирование*

Introduction

Desert and semi-desert regions represent one of the most challenging environments for architectural design due to their harsh climatic conditions, including high temperature fluctuations, low humidity, strong solar radiation, and limited water resources. These factors significantly influence the spatial organization, material selection, and functional zoning of architectural objects.

In recent years, the development of resort and health rehabilitation complexes in such regions has gained increasing importance, particularly in the context of tourism and public health improvement. These complexes not only serve recreational purposes but also provide therapeutic and preventive healthcare services, making them multifunctional systems within regional planning frameworks. The concept of tourism destination plays a crucial role in shaping such complexes, as it integrates natural, cultural, and infrastructural elements into a unified system. In desert areas, this integration is particularly sensitive, requiring a balance between environmental sustainability and functional efficiency. Despite growing interest in this field, there remains a lack of comprehensive studies focusing on the typological and compositional aspects of such complexes under extreme climatic conditions.

Therefore, this study aims to analyze the current state of architectural solutions and identify key development trends.

Methodology

The research methodology is based on a integrated approach, combining:

- Comparative analysis of existing resort and rehabilitation complexes in arid regions
- Climatic analysis of sharply continental environments
- Typological classification of architectural forms
- Compositional analysis of spatial planning structures

Scientific sources related to desert architecture, climate-adaptive design, and tourism infrastructure were analyzed. Special attention was given to the influence of sharply continental climate on building design, including thermal insulation, orientation, and structural compactness (Zenodo climate research; Climate Box Uzbekistan). Additionally, landscape characteristics of desert and semi-desert territories were studied, including soil conditions, vegetation scarcity, and ecological vulnerability (UNDP Uzbekistan project; CyberLeninka desert landscape studies). The study also incorporates data on recreational resource utilization and tourism development potential in arid regions (ResearchGate; regional tourism analyses).

Results and discussion

Typological Characteristics of Complexes

The conducted analysis demonstrates that resort and health rehabilitation complexes in desert and semi-desert environments are not formed randomly but emerge as a result of a complex interaction between climatic constraints, functional requirements, and spatial planning logic. Based on comparative analysis of existing facilities and theoretical sources, three dominant typological groups can be identified, each with distinct architectural and operational characteristics.

The first group includes compact resort complexes with centralized functional zoning, which represent the most rational solution under extreme climatic conditions. In such configurations, key functional elements—accommodation, treatment zones, recreational spaces, and service infrastructure—are concentrated

within a relatively dense spatial structure. This compactness reduces heat exchange surfaces, minimizes exposure to solar radiation, and facilitates the creation of controlled microclimatic conditions within the complex. Additionally, centralized planning improves internal connectivity, reducing movement distances for users, which is especially important for rehabilitation-oriented facilities where mobility may be limited.

The second typological group consists of dispersed eco-complexes integrated into the natural landscape. Unlike compact systems, these complexes adopt a fragmented spatial organization, where individual units (cottages, recreational pavilions) are distributed across the territory. This approach is typically applied in areas with high landscape value, where preserving the natural environment is a priority. Architectural forms in such complexes are often low-rise, organically shaped, and constructed using local materials. However, this typology requires careful planning of infrastructure networks and shading systems to mitigate the negative effects of high temperatures and solar exposure.

The third group includes sanatorium-type rehabilitation centers focused on medical services, which are characterized by a more rigid functional structure. These complexes prioritize healthcare functions, including diagnostic, therapeutic, and preventive services, and therefore require strict zoning, санитарные разрывы, and specialized инженерные решения. In desert conditions, such facilities must also incorporate climate-adaptive elements, such as thermal buffering zones, internal courtyards, and controlled ventilation systems.

Overall, the formation of these typologies is strongly determined by environmental limitations and functional priorities. Among them, compact models demonstrate higher energy efficiency and better microclimatic regulation, which is critical in hot and arid climates (Zenodo).

Compositional Solutions

The compositional organization of resort and rehabilitation complexes in desert regions reflects a deliberate adaptation to environmental stress factors, particularly solar radiation, wind activity, and temperature fluctuations. The analysis

reveals that modern architectural practice relies on a set of established compositional strategies, each contributing to environmental control and spatial efficiency.

One of the most significant strategies is the use of closed or semi-closed courtyard systems. Courtyards function as microclimatic regulators by reducing wind velocity, providing shaded outdoor spaces, and facilitating natural ventilation. In desert conditions, such systems create a buffer between external harsh environments and internal functional spaces, significantly improving thermal comfort.

Another key approach is orientation-based planning, where buildings are positioned according to solar paths and prevailing wind directions. Proper orientation minimizes direct solar exposure during peak hours and enhances cross-ventilation. This principle is particularly effective when combined with elongated building forms aligned along east-west axes.

The widespread use of shading elements, including canopies, pergolas, deep loggias, and recessed windows, represents another essential compositional feature. These elements reduce solar heat gain while allowing diffused natural light, thereby improving both energy performance and user comfort.

Furthermore, there is a clear tendency toward horizontal spatial development, where buildings are designed with limited vertical expansion. This reduces heat accumulation in upper levels and simplifies structural and инженерные решения. Horizontal layouts also facilitate better integration with the landscape and improve accessibility.

These compositional strategies are not merely aesthetic choices but are directly dictated by climatic conditions, especially intense solar radiation and temperature extremes (CyberLeninka).

Influence of Climate on Design

The sharply continental climate of desert and semi-desert regions exerts a decisive influence on architectural design, affecting both macro-level planning and micro-level construction solutions. The extreme diurnal temperature variations, low humidity, strong winds, and high solar radiation require a комплексный подход to building design.

One of the primary requirements is ensuring thermal stability. This is typically achieved through the use of high thermal mass materials, such as adobe, brick, or stone, which absorb heat during the day and release it at night, stabilizing indoor temperatures.

Natural ventilation is another critical factor. Architectural solutions must facilitate airflow through building layouts, including the use of courtyards, wind corridors, and strategically placed openings. Passive cooling techniques significantly reduce reliance on mechanical systems.

Protection from dust storms and strong winds is also essential. Buildings are often designed with aerodynamic forms, minimal external projections, and protective barriers such as vegetation belts or walls.

In addition, efficient water usage becomes a fundamental design parameter. This includes water-saving technologies, recycling systems, and the use of drought-resistant landscaping.

Research indicates that climate-responsive design strategies can significantly reduce energy consumption while enhancing indoor comfort levels, making them indispensable in arid environments (Climate Box Uzbekistan; Global Sciences).

Integration with Natural Landscape

Modern architectural approaches increasingly emphasize the integration of resort and rehabilitation complexes with their surrounding desert landscapes. This integration is not only an ecological necessity but also a functional and therapeutic requirement.

One of the primary aspects is the use of local materials, which ensures compatibility with the environment and reduces transportation costs. Materials such as clay, stone, and local composites also provide better thermal performance.

Another important principle is the minimal disturbance of natural terrain. Instead of reshaping the landscape, contemporary design seeks to adapt to existing topography, preserving natural features such as dunes, vegetation patterns, and geological formations.

The incorporation of natural therapeutic resources—including mineral waters, therapeutic mud, and climatic factors (климатотерапия)—is a defining feature of such complexes. These elements enhance the medical and recreational value of the facilities, making them unique tourism destinations.

Such integrative approaches contribute to both ecological sustainability and the effectiveness of rehabilitation processes (UNDP; ResearchGate).

The findings of this study clearly indicate that the architectural design of resort and health rehabilitation complexes in desert and semi-desert regions is fundamentally shaped by environmental and climatic constraints. Unlike conventional recreational facilities, these complexes require a higher degree of adaptability, technological integration, and environmental sensitivity.

From a typological standpoint, the transition from large, monolithic structures to more flexible and adaptive systems reflects a broader shift in architectural thinking. Modern complexes prioritize modularity, scalability, and environmental responsiveness, which allows them to function effectively under extreme conditions.

Compositional solutions increasingly rely on passive design strategies, which represent a sustainable alternative to energy-intensive mechanical systems. Techniques such as shading, orientation, and spatial compactness not only improve thermal performance but also reduce operational costs.

The concept of tourism destination plays a crucial role in the successful development of such complexes. A well-designed complex integrates natural, cultural, and infrastructural components into a cohesive system, thereby enhancing both economic viability and user satisfaction.

However, the study also highlights significant challenges. Desert ecosystems are extremely fragile, and unregulated construction can lead to irreversible environmental damage. Therefore, future development must adopt a balanced approach that combines economic objectives with ecological responsibility.

In conclusion, the evolution of resort and rehabilitation complexes in arid regions demonstrates a clear movement toward sustainability, adaptability, and

integration, which should form the basis for future architectural and urban planning strategies.

Conclusion

This study highlights that the typological and compositional solutions of resort and health rehabilitation complexes in desert and semi-desert areas are fundamentally shaped by climatic, environmental, and functional factors.

The current state of architectural practice demonstrates a clear tendency toward:

- Climate-responsive design
- Compact and efficient spatial organization
- Integration with natural landscapes
- Sustainable use of resources

Future development should focus on enhancing these approaches through innovative technologies and interdisciplinary research. The findings of this study can serve as a theoretical and practical basis for designing modern rehabilitation complexes in arid regions.

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