ARCHITECTURAL MODELING OF PUBLIC SPACES IN THE CITY OF TURKESTAN BASED ON CULTURAL HERITAGE

МӘДЕНИ МҰРА НЕГІЗІНДЕ ТҮРКІСТАН ҚАЛАСЫНДАҒЫ ҚОҒАМДЫҚ КЕҢІСТІКТЕРДІҢ СӘУЛЕТТІК МОДЕЛЬДЕУІ

АРХИТЕКТУРНОЕ МОДЕЛИРОВАНИЕ ОБЩЕСТВЕННЫХ ПРОСТРАНСТВ В ГОРОДЕ ТУРКЕСТАНЕ НА ОСНОВЕ КУЛЬТУРНОГО НАСЛЕДИЯ

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Architectural modeling, cultural heritage, public spaces, Turkestan, architectural identity, urban planning structure, morphological analysis.

ABSTRACT

The modern development of historical cities in Kazakhstan demands the actualization and necessity of design approaches that combine the principles of preserving cultural heritage with contemporary methods of shaping the urban environment. The aim of the research is to identify and systematize the architectural principles of modeling public spaces in the city of Turkestan based on cultural heritage. The methods include morphological and typological analysis of Turkestan's public spaces, graphic modeling, and comparative study of traditional forms and modern design solutions. The study applies methods of analyzing axial and visual connections, as well as constructing graphic models that reflect the hierarchy of urban architectural dominants.

The results show that architectural modeling of public spaces in Turkestan relies on preserving the cultural and historical code and adapting traditional spatial structures—such as squares, axes, courtyards, and terraces—to modern urban planning conditions. The concept of a spatial and cultural framework of the city is proposed, ensuring continuity of forms and meanings. The research demonstrates that using cultural heritage as a methodological basis for design contributes to the creation of a sustainable and identifiable urban environment that integrates history, culture, and modernity.

Түйінді сөздер:

Сәулеттік модельдеу, мәдени мұра, қоғамдық кеңістіктер, Түркістан, сәулеттік бірегейлік, қалақұрылыстық құрылым, морфологиялық талдау.

ТҮЙІНДЕМЕ

Қазақстанның тарихи қалаларының қазіргі дамуы мәдени мұраны сақтау қағидаттарын және заманауи қала ортасын қалыптастырудың қазіргі әдістерін үйлестіретін жобалық тәсілдерді өзектілендіру мен қолданудың қажеттілігін туындатады. Зерттеудің мақсаты – мәдени мұра негізінде Түркістан қаласындағы қоғамдық кеңістіктерді сәулеттік модельдеудің қағидаттарын айқындау және жүйелеу. Әдістерге Түркістанның қоғамдық кеңістіктерінің морфологиялық және типологиялық талдауы, графикалық модельдеу

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және дәстүрлі формалар мен заманауи жобалық шешімдерді салыстырмалы зерттеу кіреді. Зерттеуде осьтік және көру байланыстарын талдау әдістері, сондай-ақ қалалық сәулеттік доминанттардың иерархиясын бейнелейтін графикалық модельдерді құрастыру қолданылды.

Нәтижелер Түркістанның қоғамдық кеңістіктерін сәулеттік модельдеу мәдени-тарихи кодты сақтауға және алаң, ось, аула мен терраса сияқты дәстүрлі кеңістіктік құрылымдарды заманауи қалақұрылыстық жағдайларға бейімдеуге негізделетінін көрсетеді. Қаланың кеңістіктік-мәдени қаңқасы тұжырымдамасы ұсынылды, ол формалар мен мағыналардың сабақтастығын қамтамасыз етеді. Зерттеу көрсеткендей, мәдени мұраны жобалаудың әдіснамалық негізі ретінде пайдалану тарихты, мәдениетті және заманауилықты біріктіретін тұрақты әрі бірегей қала ортасын қалыптастыруға ықпал етеді.

Ключевые слова:	АННОТАЦИЯ
архитектурное моделирование, культурное наследие, общественные пространства, Туркестан, архитектурная идентичность, градостроительная структура, морфологический анализ.	Современное развитие исторических городов Казахстана имеет спрос на актуализацию и необходимость проектных подходов, сочетающих принципы сохранения культурного наследия и современные методы формирования городской среды. Цель исследования – выявление и систематизация архитектурных принципов моделирования общественных пространств города Туркестан на основе культурного наследия. Методы включают морфологический и типологический анализ общественных пространств Туркестана, графическое моделирование и сравнительное изучение традиционных форм и современных проектных решений. Применяются методы анализа осевых и зрительных связей, а также построение графических моделей, отражающие иерархию городских архитектурных доминант. Результаты показывают, что архитектурное моделирование общественных пространств Туркестана опирается на сохранение культурно-исторического кода и адаптацию традиционных пространственных структур, таких как площадь, оси, дворы и террасы – в современных градостроительных условиях. Предложена концепция пространственно-культурного каркаса города, обеспечивающего преемственность форм и смыслов. Исследование демонстрирует, что использование культурного наследия как методологической основы проектирования способствует формированию устойчивой и идентифицируемой городской среды, интегрирующей историю, культуру и современность.

ВВЕДЕНИЕ

The modern development of historical cities in Kazakhstan is accompanied by active urbanization processes, which necessitate finding a balance between preserving cultural heritage and introducing contemporary urban planning solutions. The relevance of this research lies in the growing interest of both the scientific and professional communities in the issues of architectural identity, the formation of sustainable public spaces, and the reinterpretation of traditional urban principles in the context of modern challenges. In the conditions of intensive urban transformation, it is especially important to preserve the cultural and historical code that shapes the uniqueness and integrity of the architectural image of historical cities. Of particular interest in this context is the city of Turkestan- one of Kazakhstan's most important historical and spiritual centers, where traditional forms of nomadic architecture, sacred landscapes, and modern urban planning coexist within a unified spatial environment. The city's rapid

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development in recent years has brought to the forefront the issues of preserving cultural identity and shaping a sustainable spatial structure that reflects the region's historical and cultural specificity (Tanzharykovva & Maulenova, 2024).

The aim of this research is to identify and systematize the architectural principles of modeling public spaces in Turkestan based on cultural heritage. The research objectives include analyzing the morphological and typological structure of Turkestan's public spaces, identifying traditional architectural and spatial archetypes influencing the formation of the urban environment, developing architectural modeling principles based on the synthesis of traditional and modern urban design approaches. The object of the research is the public spaces of the historical city of Turkestan. The subject of the research is the architectural principles and models of forming these spaces in the context of cultural heritage. The methodological framework includes morphological and typological analysis, graphic modeling, comparative study of traditional and modern forms, as well as methods of spatial-semiotic analysis.

The scientific novelty of the research lies in the fact that architectural modeling is considered not only as a design tool but also as a means of identifying and interpreting cultural archetypes that underlie the formation of the urban environment. This approach allows integrating historical and cultural meanings into contemporary architectural design and contributes to the creation of a holistic, identifiable architectural and semiotic system of the city (Saikeneva, 2025).

MATERIALS AND METHODS OF RESEARCH

Historical and cultural sources, archival maps, urban planning schemes, and satellite images of the city of Turkestan were used as research materials, along with literary and theoretical works on the traditional architecture of nomadic peoples and contemporary urban development trends. The empirical base was formed by projects for the reconstruction and development of the city, archival plans of Turkestan, satellite imagery, and a comparative analysis of archetypal models of nomadic architecture (Abdrassilova & Danibekova, 2021).

The methodology is based on a combination of morphological and comparative analysis of all available structures, which made it possible to identify key spatial frameworks, interpret them as elements of the cultural code, and determine the principles of synthesizing traditional and modern forms in the public spaces of Turkestan (Carmona, 2010).

Special attention was paid to identifying the stable semantic layers of the urban environment and their role in shaping spatial identity. This approach made it possible to consider public spaces not only as functional elements but also as carriers of cultural meanings that ensure the continuity of architectural traditions in the context of the city's modern development (Saikeneva, 2025).

METHODOLOGICAL APPROACHES TO THE MODERNIZATION OF PUBLIC SPACES

The modernization of public spaces in the city of Turkestan is based on the principles of preserving historical and cultural heritage and integrating it into the contemporary architectural environment. The main goal is not only to renew the physical structure of the urban fabric but also to form a sustainable system of public interactions that reflect the cultural identity of the region. In the process of architectural modeling, three interrelated directions of modernization are considered: spatial-planning, architectural-artistic, and socio-cultural (Hillier & Hanson, 1984).

The spatial-planning direction is associated with restoring the logic of historical routes, visual axes, and traditional compositional centers characteristic of old Turkestan. It aims to ensure continuity of the urban structure while creating modern public spaces (Kurokawa, 1997).

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Particular importance is given to organizing pedestrian connections, visual perspectives, interaction with sacred sites, and harmonizing development with the natural landscape (Hamidreza, Reza & Kiashari 2018).

The architectural-artistic direction involves reinterpreting traditional forms, ornaments, and structural solutions through the contemporary language of architecture. The use of motifs from folk decorative art, local building materials, and characteristic proportions helps preserve a visual connection with the historical environment and emphasize the city's unique identity (Tihova & Kuleeva, 2020).

The socio-cultural direction of modernization focuses on creating spaces that promote communication, cultural exchange, and the development of local initiatives. Such spaces serve as venues for events, exhibitions, educational and creative programs, forming a lively and dynamic urban environment (Cybajkin, 2024). Special attention is paid to accessibility, inclusivity, and the involvement of local residents in the processes of urban transformation (Figure. 1).

Thus, the modernization of Turkestan's public spaces is not viewed as the destruction or replacement of the historical context but as its consistent development under contemporary conditions. The combination of traditional elements and innovative approaches forms the basis for creating an architectural environment capable of preserving cultural memory while meeting the needs of modern society.
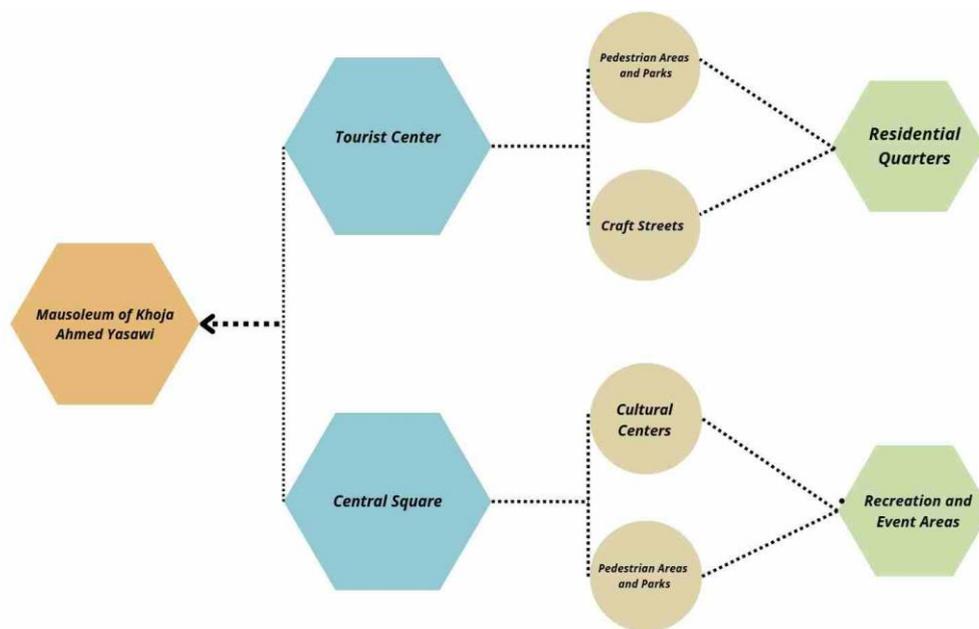
Figure 1. Graph model of public interactions in the urban environment of Turkestan
Note – compiled by the author(s) based on data (Official Information Resource of the Prime Minister of the Republic of Kazakhstan, 2025)

APPLICATION OF ARCHITECTURAL MODELING IN THE PROCESS OF MODERNIZING PUBLIC SPACES

Based on the identified directions of modernization (spatial-planning, architectural-artistic, and socio-cultural), principles of architectural modeling were developed aimed at creating an integrated system of public spaces reflecting the historical and cultural specificity of the city of Turkestan. The spatial-planning model is based on an analysis of the city's historical connections and territorial structure. The compiled cartographic framework made it possible to identify patterns in the placement of sacred and public sites, the movement routes of pilgrims

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and tourists, as well as key visual and pedestrian axes connecting the Khoja Ahmed Yasawi Mausoleum with contemporary public zones (Tanzharykovva & Maulenova, 2024; Abdrassilova & Danibekova, 2021).

Based on this analysis, a graph model of interactions was created, reflecting the intensity of flows, points of activity concentration, and nodes of public interaction. This model serves as a tool for forecasting territorial development, allowing the identification of areas where recreational and cultural functions need to be enhanced.

The architectural-artistic model provides for the inclusion of elements of traditional decoration, local building materials, and proportional relationships characteristic of Turkestan architecture. For example, in the reconstruction projects of the central square and the embankment of the Yassy River, motifs of geometric ornamentation and brickwork reminiscent of traditional patterns of the mausoleum are applied. This contributes to visual continuity and the formation of a recognizable urban environment (Hamidreza, Reza & Hadie, 2018).

The socio-cultural component of the modeling is reflected in the creation of public zones with active participation of local residents. For instance, in the improvement projects of pedestrian routes around the mausoleum and street areas for craft fairs, spaces for temporary exhibitions, street theaters, and art workshops are provided. Such spatial organization enhances community engagement, contributes to the preservation of intangible cultural heritage, and strengthens the city's identity (Tihova & Kuleeva, 2020).

Thus, the applied methods of architectural modeling in Turkestan are aimed at forming a sustainable urban structure where historical memory and contemporary needs are harmoniously integrated. The use of cartographic analysis and graph modeling made it possible to identify key modernization zones, integrate them into the cultural context, and ensure continuity in the development of the urban environment.

RESULTS AND DISCUSSION
SPATIAL ARCHETYPES AND TRADITIONAL NOMADIC FORMS

The architectural spaces of ancient nomadic settlements in Kazakhstan were formed based on simple and universal archetypes, which over the centuries have preserved stable morpho-logical and semantic characteristics (Hillier & Hanson, 1984). The existing architectural archety-pes of Kazakhstan- "platform," "pyramid," "avenue," and "tower" are found in various cultures around the world; however, in nomadic architecture, they acquired a special interpretation closely linked to the worldview and the complex structure of nomadic life (Figure 2).
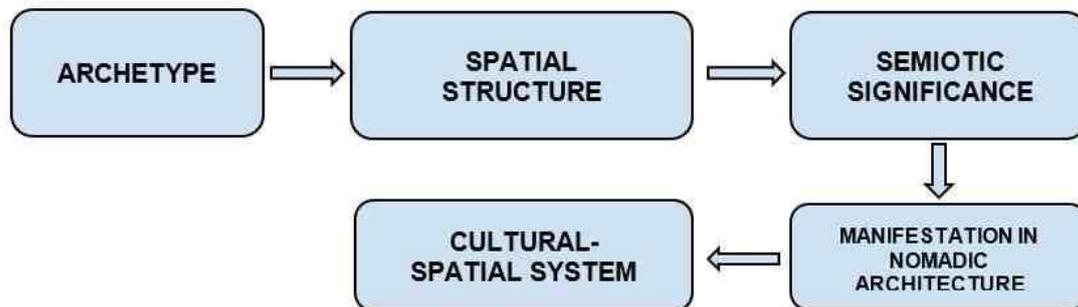
Figure 2. Paradigm of Archetypes and Semiotic Meanings.
Note – compiled by the author(s)

The yurt occupies a central place in spatial organization as a key form- circular in plan and domed vertically- embodying the idea of centrality and the axis of the world, connecting the earth and the sky. The hearth, located at the center, was not only a functional element but also a semiotic marker of the center of the universe, while the dome symbolized the celestial vault. Thus,

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spatial archetypes in nomadic architecture represent not merely construction schemes but multi-layered semantic structures that form a unique cultural and spatial system (Sajfurova, 2022).

SPATIAL ARCHETYPES IN THE MAUSOLEUMS OF TURKESTAN

In the contemporary urban structure of Turkestan, the spatial archetypes of traditional architecture are not only preserved but are also purposefully integrated into current design solutions, forming a stable spatial-semantic foundation for the city (Saikeneva, 2025). The planning organization of public spaces is based on principles of centrality and axial composition, manifested in the system of boulevards and thoroughfares oriented toward key spiritual and cultural landmarks- primarily the Khoja Ahmed Yasawi Mausoleum. Vertical accents in modern buildings, including minarets, towers, and domed elements, function as visual markers, maintaining the historically established hierarchy of the city skyline. The use of platform-based foundations and terraces enhances the compositional expressiveness of public buildings and emphasizes their significance within the urban structure (Sajfurova, 2022).

Thus, the contemporary development of Turkestan demonstrates a consistent integration of traditional spatial archetypes into the modern planning system, contributing to the preservation of the city's cultural identity and the formation of a cohesive architectural-urban environment (Abdrassilova & Danibekova, 2021).

PROCEDURE FOR ARCHETYPE IDENTIFICATION

For a systematic analysis of Turkestan's public spaces, a procedure for identifying architectural archetypes was developed, based on a combination of visual-graphic and morphological methods. The aim was to determine the extent to which a specific space preserves or interprets the historical and cultural principles of the region's architecture. The process includes several consecutive stages: recording the object of analysis, describing its morphological characteristics, comparing them with archetypal models, and determining the degree of correspondence to the cultural code (Toleukhanova, 2019).

Each morphological characteristic is evaluated on a binary principle (yes/no): the presence of a platform foundation corresponds to the "platform" archetype; central organization and axial orientation correspond to the "centrality" archetype; vertical accent corresponds to the "tower/dominant" archetype; inner courtyard corresponds to the "courtyard space" archetype; interaction with the natural terrain corresponds to the "landscape integration" archetype. The number of matches is interpreted as the level of archetypality of the object: high correspondence 4–5 features, medium 2–3, low 0–1. Results are visualized in tables and graphical schemes, allowing an assessment of the spatial-cultural density of the urban environment.

An example is the Yassy embankment: prior to reconstruction, the space was fragmented, lacking a defined composition (low archetypality), whereas after reconstruction, the area acquired a terraced structure, axial directions, and visual corridors, raising the score to 4 out of 5. This method allows the identification of the dynamics of transformation of architectural archetypes and the degree of their adaptation to modern design conditions.

This procedure is universal and can be applied to the analysis of other historical cities in Kazakhstan, providing the possibility of quantitatively evaluating the continuity of forms and the architectural identity of the environment (Abdrassilova & Danibekova, 2021).

LIMITATIONS AND VALIDITY

Despite the systematic nature of the approach, the developed model has several limitations related to temporal, selective, and contextual factors. First, the temporal aspect: seasonal changes in lighting, microclimate, and the density of public space usage were not considered, which affects the perception of squares, courtyards, and embankments (Donchenko & Samoylov, 2020). During summer and winter periods, visual axes change, routes shift, and space functions

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transform. Second, sample limitation: the study focused on five key nodes of the central cluster, although Turkestan also includes peripheral zones that could alter the graph structure and the ranking of dominant elements. Third, the subjective factor: perception of architectural identity depends on the cultural experience of the observer, necessitating further sociological and behavioral studies (Hillier & Hanson, 1984).

Additionally, architectural modeling inevitably simplifies the real environment, not reflecting parameters such as material, color, sound, and microclimatic characteristics (Figure 2).

To improve the accuracy of analysis, it is recommended to integrate graph modeling methods with data from geographic information systems (GIS), space syntax, and 3D scanning, enabling quantitative assessment of pedestrian flow density and visual connectivity of nodes. The validity of the model is confirmed by comparison with archival and field materials, but further testing is required in practical design.

Therefore, architectural modeling of Turkestan's public spaces should be considered as an adaptive analytical-design tool, sensitive to contextual changes and based on the continuity of cultural layers. Despite the outlined limitations, the proposed model has high representativeness for the central historical-cultural core of the city and demonstrates significant potential for application in the reconstruction and development of historical areas in Kazakhstan (Figure 3).
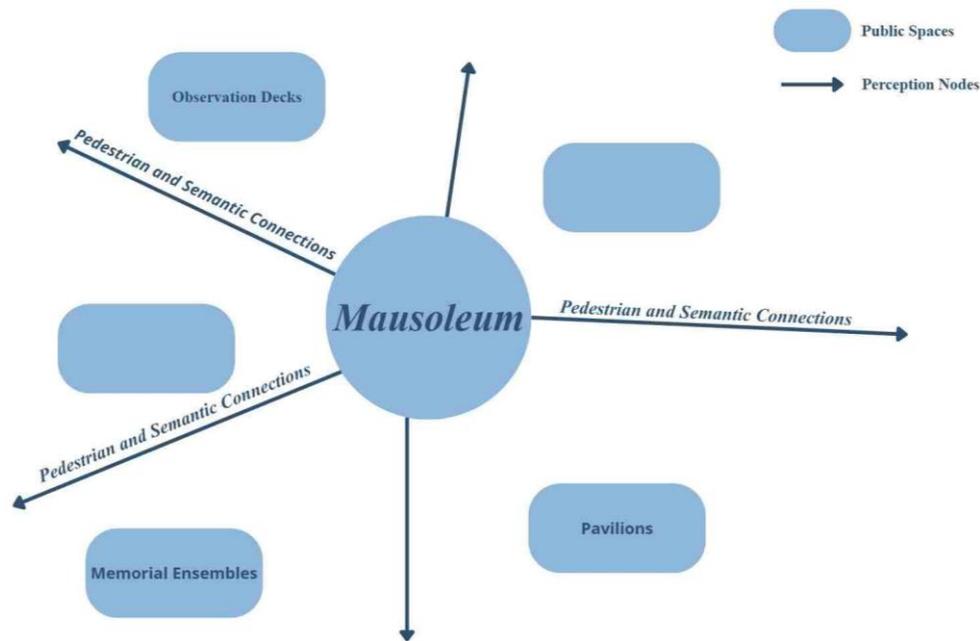
Figure 3. Graph Diagram of the Semiotic Structure

Note – compiled by the author(s) based on data (Official Information Resource of the Prime Minister of the Republic of Kazakhstan, 2025)

At the same time, the "platform" archetype is actively employed- elevated terraces, podiums, and platforms create spatial levels that enhance the perception of key dominants and establish a symbolic distinction between profane and sacred spaces.

The central and platform-based organization of space is considered one of the key methods of symbolic centering in the urban environment. In Turkestan, this principle is implemented in the spatial composition of the square in front of the mausoleum, which is situated on a raised foundation and surrounded by symmetrical architectural components. This planning structure serves as the spatial core of the tourist cluster and functions as a place of collective presence – a modern analogue of the central square of a nomadic encampment, where public gatherings and

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ritual activities traditionally took place. The platform elevation establishes the hierarchy of the space, while the central organization reinforces the semiotic function of the mausoleum as the spiritual center of the city system. The sacred significance of the complex is confirmed by the fact that the Yasawi Mausoleum is included in the UNESCO World Heritage List as an example of the region's cultural symbol and architectural dominant.

The third archetype the vertical dominant- historically manifested through minarets and tower structures, which served as reference points within the sacred-spatial field. In contemporary urban planning solutions in Turkestan, this archetype is transformed into a system of vertical accents shaping the skyline along the main axis (Figure 4).

Figure 4. Vertical Structure of Turkestan City
Note – borrowed from the work of Davtyan K (2018).

A striking example is the "Visitor Center" with a pronounced tower dominant, visually marking the entrance to the historic part of the city. The vertical elements function as spatial landmarks and semiotic markers, comparable to minaret- they not only reinforce the visual hierarchy in a deliberate manner but also carry the symbolic meaning of sacred presence. Studies on the architectural development of Turkestan emphasize that contemporary projects aim to preserve visual dominants, integrating them into the city skyline to maintain the continuity of cultural identity (Figure 5).

Figure 5. Visitor Center, Turkestan City.
Note – borrowed from the work of Abdirayim K (2023).

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The central node is the mausoleum. From it extend connections to other nodes- squares, ensembles, and alleys. These represent visual, pedestrian, and semantic links. The purpose is to analytically illustrate a network of semiotic relationships rather than merely planning axes.

The fourth archetype- the courtyard structure- originates from the spatial organization of traditional residential complexes and religious centers (madrasas, caravanserais), where inner courtyards functioned as protected and sacred spaces. In Turkestan, this principle is evident in ensembles of cultural and tourist facilities, especially in the architecture of hotels, museums, and pavilions adjacent to the mausoleum. Inner courtyards provide a favorable microclimate, create semi-private zones for communication, and refer to the archetype of the "inner world," where spiritual life is concentrated. Semiotic interpretation defines such spaces as symbols of order and seclusion, corresponding to the Islamic tradition of architectural environments, although direct publications on their implementation in Turkestan require further clarification in academic sources.

The landscape-integrated structure, the fifth archetype, is based on the strong connection between architecture and the natural environment- characteristic of steppe culture, where the natural landscape became part of the spatial system of the settlement. In Turkestan, this logic is embodied in the improvement of the Yassy River embankment and the adjacent green zones, where architecture is embedded in the terrain through terracing, the use of natural materials, and visual corridors oriented toward the mausoleum as the center. In semiotic terms, the landscape ceases to be a neutral backdrop and becomes sacred matter through which the image of the city as a spiritual and natural whole is manifested.

The main architectural dominant- the Yasawi Mausoleum is located at the center of these visual connections (the "landscape ↔ center" axis) and is perceived as an organic part of the region's natural and cultural landscape, forming the symbolic core of the city.

Thus, within the urban structure of contemporary Turkestan, the consistent realization of key spatial archetypes- central, vertical, courtyard, and landscape- is observed. Each of these archetypes not only performs a compositional function but also acts as a bearer of stable cultural and semiotic meanings. These archetypes form the foundation for the development of a multilayered symbolic system of the urban environment, ensuring continuity between historical symbolism and modern urban practices (Table 1).

Table 1. Comparison of Spatial Archetypes and Semiotic Models
in the Architecture of Turkestan

Archetype	Spatial Structure	Manifestation in Traditional Architecture	Modern Urban Planning Solutions	Semiotic Meaning
Platform	Horizontal base / platform	Podium and terraces of the Khoja Ahmed Yasawi	Mausoleum Formation of pedestrian plazas and memorial ensembles	Foundation of the world, sacred place under the sun, fixation of the center
Pyramid / Dome	Vertical, ascending structure	Domed coverings of the Khoja Ahmed Yasawi	Mausoleum Modern domed pavilions and tent structures in public areas	Connection between heaven and earth, sacredness, symbol of ascension

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end of table 1

		Main entrance axes and internal enfilades of mausoleums	Tourist and pedestrian routes, longitudinal axes of the planning structure	Direction of movement toward the sacred center, ritual path
Avenue / Axial Organization	Linear, longitudinal structure			
Tower / Vertical Accent	Vertical compositional dominant	Minarets and tower elements	Vertical accents- pylons, towers, observation points	Axis of the world, landmark, symbol of spiritual ascension

Note – the table was developed by the author based on an analysis of the literature (Baidabekov, & Kemelbekova, 2024; Ostapenko, Bekturganova, Dyussenova, Chekaeva, & Yessenbayev, 2025; Abdrassilova, Danibekova & Kuc, 2021; Samoilov, Kuspangaliyev, Sadvokasova & Akhmedova, 2023)

AUTHOR'S CONCLUSIONS AND POSSIBILITIES OF SYNTHESIS

The conducted analysis has shown that the spatial archetypes underlying the traditional nomadic architecture and mausoleums of Turkestan represent stable morphological and semiotic structures with high potential for contemporary urban modeling. Their use in the design of public spaces makes it possible not only to ensure the continuity of architectural tradition but also to form an integral cultural and semantic framework of the urban environment, capable of transmitting historical memory and local identity (Saikeneva, 2025; Sajfurova, 2022).

One of the key principles identified in the course of the study is centrality, which traditionally lay at the core of the spatial organization of yurt settlements and mausoleums. In contemporary urban planning, this principle can be applied to the formation of compositional and functional nodes- central squares, memorial complexes, and public centers (Saikeneva, 2025).

Equally important is the use of tent-like and domed forms, which historically symbolized the connection between the earthly and celestial realms. In modern architectural and urban practice of Turkestan, these forms can function as semiotic markers, emphasizing sacred, cultural, and socially significant spaces, creating visual dominants, and enhancing the spatial and semantic expressiveness of the environment. A special role is also played by the formation of linear-longitudinal axes, interpreted as spatial embodiments of historical and spiritual routes. Incorporating such axes into the modern planning structure of the city makes it possible to actualize historical memory, guiding pedestrian flows toward key points of the cultural landscape and ensuring the semiotic legibility of the urban fabric. In addition, a promising direction is the creation of multi-level spatial compositions based on the synthesis of archetypal models such as the *"platform"*, *"pyramid"*, and *"alley."* Such solutions make it possible to convey the multi-layered historical and cultural context of Turkestan through architectural and spatial means, forming public spaces rich in meaning (Sajfurova, 2022).

Thus, the application of spatial archetypes in the design of public spaces in Turkestan goes far beyond simple decorative citation. It represents a deliberate process of semiotic modeling, in which architectural and planning decisions are meaningfully correlated with local cultural codes.

This approach contributes to strengthening the identity of the urban environment, maintaining the continuity of architectural tradition, and forming an expressive city image within the context of its dynamic modern development.

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CONCLUSION

Thus, the conducted analysis of the historical, cultural, and architectural prerequisites for the formation of the spatial environment of the city of Turkestan made it possible to identify stable patterns that determine the morphogenesis of architectural and urban structures. The study has shown that architectural modeling of public spaces in Turkestan should be based on the principles of continuity of cultural archetypes and the historical hierarchy of dominants. The formation of architectural form reveals a universal sequence: from the development of the horizontal plane and basic planning configurations (circle, square, perimeter schemes) to vertical shaping and the subsequent development of volumetric and spatial structures. This logic is fundamental both for traditional nomadic architectural types and for the sacred and public buildings of historical Turkestan (Saikeneva, 2025).

Vertical dominants in the form of towers, minarets, and domed elements, based on platform solutions, perform not only structural and compositional but also semiotic functions—reinforcing the hierarchy of the city silhouette and forming a system of visual landmarks. The combination of horizontal terraced bases with vertical accents creates a characteristic spatial dramaturgy in which architectural elements serve as carriers of cultural codes and symbolic meanings (Sajfurova, 2022).

Contemporary urban trends in Turkestan demonstrate a deliberate effort to synthesize traditional archetypal forms with new bionic and technological design principles. Bionic approaches contribute to the adaptation of historical morphological patterns to current functional, ecological, and social requirements, while preserving symbolic meaning and cultural continuity.

The identified patterns confirm the universality of the principles governing the formation of volumetric and spatial structures, opening up opportunities for their methodological extrapolation to contemporary urban planning practice. The synthesis of traditional archetypes and innovative form-making approaches enables the creation of holistic public spaces capable of not only preserving the city's cultural and historical identity but also addressing the challenges of sustainable development and the symbolic representation of the urban environment (Hamidreza, Reza & Hadie 2018).

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