



Article

Architectural and Planning Analysis of The Kafir Kala Archaeological Site in Samarkand District And Principles for its Graphical Reconstruction

Djumaqulov Fozil Uzoqovich^{1*}, D. Zarifova Bahrom kizi²

1. PhD in Architecture, Acting Associate Professor, Samarkand State University of Architecture and Construction, Samarkand, Uzbekistan
2. Master's Student, Department of History and Theory of Architecture, Samarkand State University of Architecture and Construction, Samarkand, Uzbekistan

*Correspondance: djumoqulov1985@gmail.com

Citation: Uzoqovich, D. F., Bahrom kizi, D. Z. Architectural and Planning Analysis of The Kafir Kala Archaeological Site in Samarkand District And Principles for its Graphical Reconstruction. Web of Scholars: Multidimensional Research Journal 2026, 5(3), 294-300.

Received: 15th Apr 2026

Revised: 05th May 2026

Accepted: 20th May 2026

Published: 06th Jun 2026



Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>)

Abstract: This article examines the architectural and planning structure, defensive system, and scientific principles for the graphical reconstruction of the entrance section of the Kafir Kala archaeological complex located in the southern part of the Samarkand oasis. The research is based on historical and archaeological sources, existing photographic materials, comparative analysis with analogous sites, and architectural reconstruction methods. Kafir Kala is interpreted not merely as a defensive structure but as a multifunctional complex that served as a strategic, administrative, and symbolic center within the urban planning system of the Samarkand region during the Sogdian period. Particular attention is given to the fortress entrance, which is evaluated as a multifunctional architectural element responsible for defense, movement control, compositional orientation, and the representation of political authority. As a result, a step-by-step scientific model for the graphical reconstruction of the Kafir Kala entrance is proposed, based on archaeological evidence, volumetric and proportional logic, material and structural compatibility, conservation ethics, and digital documentation principles.

Keywords: Kafir Kala, Samarkand Oasis, Sogdian Architecture, Archaeological Heritage, Defensive Architecture, Gate Composition, Graphical Reconstruction, Digital Documentation, Conservation

1. Introduction

Archaeological monuments located within the territory of Uzbekistan represent an invaluable scientific source for studying the urban development, defensive architecture, and historical landscape evolution of Central Asia. In particular, the Samarkand Oasis was one of the major centers of Sogdian civilization during antiquity and the early medieval period[1]. The fortresses, urban settlements (shahristans), suburbs (rabads), canal networks, and craft-production zones that developed around it formed a complex urban planning system. One of the most significant components of this system is Kafir Kala, which, due to its topographical location, defensive structure, administrative significance, and archaeological findings, is regarded as an important archaeological site revealing the historical and cultural layers of the region[2].

In recent years, international research conducted at Kafir Kala has considerably expanded the scholarly understanding of the monument. Investigations carried out within the framework of the Italian-Uzbek Archaeological Project and the Uzbek-Japanese archaeological expeditions have provided significant information regarding the fortress's

stratigraphy, topography, numismatic materials, sealings (bullae), fragments of wood carvings, and the potential of digital documentation techniques. These findings support the interpretation of Kafir Kala not merely as a defensive outpost, but as a complex architectural and urban entity that played an active role in the political-administrative, economic, and cultural system of the Samarkand Oasis[3].

The relevance of this study lies in the fact that the graphical reconstruction of archaeological sites often relies excessively on artistic interpretation, which may result in an imbalance between scientific evidence, archaeological remains, structural logic, and conservation ethics. Therefore, the reconstruction of the entrance section of Kafir Kala requires an evidence-based, verifiable, and step-by-step methodological approach in which different levels of certainty are clearly identified[4].

The aim of this research is to analyze the architectural and planning characteristics of the Kafir Kala archaeological complex on the basis of scientific sources and to develop conceptual and methodological principles for the graphical reconstruction of its entrance section[5].

The objectives of the study are: (1) to determine the place of Kafir Kala within the urban planning system of the Samarkand Oasis; (2) to analyze the functional significance of the fortress's defensive system and entrance section; (3) to classify the evidence base required for graphical reconstruction; (4) to establish compositional, structural, and conservation criteria for the reconstruction of the entrance section; and (5) to propose a step-by-step algorithm for the reconstruction process[6].

2. Methodology

The study employed historical and archaeological analysis, a comparative-typological approach, visual and photogrammetric observation, architectural compositional analysis, comparison with analogous sites, principles of conservation ethics, and digital modeling techniques. Within this framework, the reconstruction outcome is regarded not as a final and definitive representation, but rather as a hypothetical scientific model based on available evidence.

3. Results and Discussion

Historical, Topographical, and Urban Context of Kafir Kal

The Kafir Kala archaeological complex is located approximately 12 km southeast of Afrasiab, on the left bank of the Dargom Canal. In antiquity, it controlled one of the major routes connecting the city of Samarkand with the southern regions [7]. Such a location indicates that the fortress may have served not only military purposes but also functions related to transportation, communication, and economic control.

Researchers consider the Kafir Kala complex as a combination of a central rectangular citadel, an internal moat and tower system, a surrounding residential area (shahristan), an external moat, a rabad located on the western side, a necropolis, and pottery production zones. This demonstrates that the site should be understood not merely as an isolated fortress, but as a complex archaeological landscape integrating defensive, residential, administrative, craft-production, and ritual-cultural functions[8].

The relationship between the natural boundaries of the Kafir Kala area—including canals, streams, and artificial hydraulic structures—and its defensive organization indicates that the defense strategy was closely integrated with the surrounding landscape. In the defensive architecture of Central Asia, such an approach corresponds to the principle of combining natural relief, water-management systems, and artificial fortification elements into a unified line of defense. Therefore, the reconstruction of the Kafir Kala entrance should take into account not only the architectural form of the gate

itself, but also the access road leading to it, the crossing point over the moat, the adjacent defensive walls, and the system of visual surveillance and control[9].



Figure 1. General view of the Kafir Kala archaeological complex within its present-day landscape.

Architectural and Planning Analysis: The Defensive System and the Role of the Entrance

The principal characteristic of the Kafir Kala defensive system is the formation of a layered defense organized around the central citadel. The interaction between the fortress walls, towers, moat, inner courtyard, and outer areas created a multi-level control mechanism. Sources indicate the presence of an inner moat surrounding the citadel, reinforced by six towers. Such an arrangement suggests that the entrance point was not accidental but rather a carefully planned defensive and compositional focal element[10].

In fortification architecture, the entrance section represents both the most vulnerable and the most important component of the defensive system. It serves as the point through which access to the fortress is controlled, military supervision is exercised, taxes or goods are regulated, ceremonial receptions are conducted, and political authority is symbolically expressed[11]. Therefore, the following aspects should be considered as key scientific criteria in the graphical reconstruction of the Kafir Kala entrance: the gate axis, the route crossing the moat, the possible presence of flanking walls and bent-access passages, the compositional role of towers or observation points, the façade appearance of the entrance, and the internal circulation scenario.

In complexes such as Kafir Kala, constructed primarily of rammed earth and mud brick, the physical properties of the building materials are also of crucial importance for reconstructing the entrance section. Rammed-earth walls are characterized by their substantial mass and thick structural body[12]. Their original height and form can be reconstructed through the analysis of wall remnants, collapse deposits, foundation traces, remains of rooms and corridors, platform elevations, and patterns of climatic deterioration. Consequently, the graphical model should not be regarded merely as an aesthetically appealing representation; rather, it must constitute a scientific reconstruction based on the systematic analysis of archaeological evidence and structural characteristics[13].



Figure 2. Preserved mud-brick and rammed-earth structures, as well as internal spatial fragments, at the Kafir Kala site.

Source: Prepared by the authors based on photographic materials from the primary study.

Evidence Base and Scientific Limitations for Graphical Reconstruction

The process of graphical reconstruction should be based on the degree of reliability of the available evidence. In the case of Kafir Kala, the evidence can be classified into three categories. The first category consists of direct archaeological evidence, including preserved wall remains, traces of moats, foundation lines, floor levels, and the boundaries of corridors and rooms[14]. The second category comprises indirect evidence, such as stratigraphic data, archaeological finds, fire layers, sealings (bullae), numismatic materials, and historical written records. The third category includes analogical evidence derived from comparisons with other early medieval fortresses and palace-residences of Sogdiana, Bactria, and Central Asia.

One of the most important issues in scientific reconstruction is distinguishing between evidence-based conclusions and hypothetical assumptions. Elements reconstructed on the basis of preserved foundations or wall traces should be classified as having a high level of reliability. Architectural features such as elevations and decorative components reconstructed through comparative analysis with analogous monuments should be assigned a medium level of reliability. In contrast, artistic and compositional additions lacking direct supporting evidence should be regarded as having a low or conditional level of reliability. In international conservation and restoration practice, such an approach ensures scientific integrity and allows reconstructed models to be verified and refined through future research[15].

Table 1. Evidence Types and Their Application Criteria in the Graphical Reconstruction of the Kafir Kala Entrance

Evidence Type	Nature of the Source	Function in Reconstruction	Reliability Level
Wall and foundation remains	Direct archaeological evidence	Determination of the plan, wall thickness, entrance axis, and structural boundaries	High

Moat, canal, and relief traces	Topographical and landscape evidence	Identification of access routes, defensive lines, and movement scenarios	High/Medium
Archaeological finds and stratigraphy	Historical and archaeological context	Determination of chronology, function, and phases of use	Medium
Analogues of Sogdian fortresses	Comparative and typological evidence	Estimation of gate volume, towers, and façade composition	Medium/Low
Digital models and photogrammetry	Documentation tool	Preservation of the existing condition and presentation of hypothetical reconstructions in separate layers	High, if based on measured data

A Phased Model for the Graphical Reconstruction of the Entrance Section

The proposed model for the reconstruction of the Kafir Kala entrance consists of five stages. During the first stage, the existing archaeological condition is accurately documented through photographic recording, measured drawings, drone imagery, point-cloud surveys, or photogrammetric modeling. In the second stage, the entrance axis, the route crossing the moat, the defensive walls, and possible flanking defensive elements are identified based on the site plan. The third stage involves a comparative analysis with analogous monuments in order to develop possible variants of the volumetric composition.

During the fourth stage, a two-dimensional graphical reconstruction is produced, including the master plan, elevations, sections, and axonometric drawings. At this stage, preserved elements, scientifically reconstructed elements, and hypothetical supplementary elements should be clearly distinguished through different line weights, line types, or graphic conventions. In the fifth stage, a three-dimensional model and visualization are developed. However, the 3D model should not replace scientific drawings; rather, it should serve as a means of presenting research results in an accessible form for museum interpretation, public dissemination, and educational purposes.

This model integrates two principal objectives in the reconstruction of the Kafir Kala entrance. First, it ensures the preservation of the scientific accuracy of the archaeological site. Second, it enables the historical appearance of the monument to be presented in a clear and visually accessible manner for a broader audience. Therefore, it is recommended that each graphical reconstruction explicitly indicate the levels of “direct evidence,” “scientific hypothesis,” and “visual supplementation.”

The entrance of Kafir Kala may be interpreted not merely as a component of the fortification system but also as one of the semantic and compositional focal points of the entire complex. In the architecture of early medieval Sogdiana, palace-residences, administrative centers, and defensive structures were often not strictly separated; instead, they functioned as integrated components of a unified complex. The numerous sealings (bullae) and archaeological finds discovered at Kafir Kala strengthen scholarly interpretations suggesting that the site may have been associated with an administrative center or a ruler’s residence.

Within such a complex, the gate served not only as an entrance but also as a symbol of passage through a controlled boundary. The transition from the external environment into the protected interior space was regulated through architectural means, including the narrowing of access routes, the control of sightlines, surveillance from flanking towers, the psychological impact of massive defensive walls, and the compositional sequence leading toward the inner courtyard. Therefore, graphical reconstruction should illustrate not only the façade of the entrance but also the spatial scenario associated with its use and movement patterns.

Previous experiences in digital documentation and three-dimensional modeling of Kafir Kala provide an important methodological foundation for this approach. In

particular, contemporary archaeological practice demonstrates that 3D modeling facilitates the preservation of the current condition of a site, the documentation of excavation processes, the digital archiving of endangered elements, and the controlled presentation of alternative scientific reconstruction scenarios.

Based on the findings of this study, the following scientific and practical recommendations for the graphical reconstruction of the Kafir Kala entrance have been developed:

A dedicated evidence map of the entrance area should be prepared, displaying preserved wall remains, moats, access routes, and potential structural traces within a single integrated plan.

The graphical reconstruction should be presented in at least three distinct layers: the existing condition, scientifically reconstructed elements, and hypothetical visual additions.

The master plan, elevations, sections, and 3D model should be developed within a unified coordinate and scale system to ensure consistency and comparability.

The actual physical properties of rammed-earth and mud-brick constructions—including wall thickness, deterioration processes, sensitivity to moisture, structural massiveness, and reconstruction limitations—must be taken into account.

When reconstruction results are adapted for museum interpretation and tourism purposes, scientific hypotheses and historically verified facts must be clearly distinguished.

As a future stage of research, it is advisable to develop a digital passport of the Kafir Kala entrance based on photogrammetry, GIS technologies, laser scanning, and archaeological databases.

4. Conclusion

The Kafir Kala archaeological complex represents a major architectural and landscape ensemble strategically located within the early medieval urban system of the Samarkand Oasis, integrating defensive, administrative, and cultural functions.

The entrance section of the fortress constituted one of the most important components of the defensive system, potentially serving functions related to movement control, security, compositional guidance, and the symbolic representation of authority.

The process of graphical reconstruction of the entrance should be carried out on the basis of archaeological evidence, topographical traces, comparative analogues, material and structural logic, and the principles of conservation ethics.

If the boundary between evidence and hypothesis is not clearly defined in graphical reconstruction results, the scientific interpretation of the monument may be distorted. Therefore, the levels of reliability should be explicitly indicated in every reconstruction drawing.

In the case of Kafir Kala, a comprehensive approach integrating digital documentation, two-dimensional drawings, three-dimensional modeling, and scientific interpretation constitutes an effective methodology for the preservation, study, and public presentation of archaeological heritage.

The proposed phased reconstruction model can serve not only as a scientifically grounded approach for the reconstruction of the Kafir Kala entrance but also as a methodological framework applicable to other archaeological fortresses in Uzbekistan.

REFERENCES

- [1] S. Mantellini and A. E. Berdimuradov, "Archaeological explorations in the Sogdian fortress of Kafir Kala, Samarkand Region, Republic of Uzbekistan," *Ancient Civilizations from Scythia to Siberia*, vol. 11, no. 1–2, pp. 107–132, 2005.
- [2] T. Usami, A. Begmatov, T. Uno, A. Berdimuradov, and G. Bogomolov, "Archaeological Excavation and Documentation of Kafir Kala Fortress," *Studies in Digital Heritage*, vol. 1, no. 2, pp. 785–796, 2017, doi: 10.14434/sdh.v1i2.23267.
- [3] A. Gariboldi, S. Mantellini, and A. Berdimuradov, "Numismatic Finds from Kafir Kala as Evidence of the Islamic Transition in Samarkand," in *The Nani Collection of Arabic Coins through Unpublished Documents & Drawings by Jean François Champollion, A. D'Ottone Rambach*, Ed. Trieste: EUT Edizioni Università di Trieste, 2018, pp. 97–126.
- [4] A. Begmatov, A. Berdimurodov, G. Bogomolov, T. Uno, T. Usami, et al., "New Discoveries from Kafir-kala: Coins, Sealings, and Wooden Carvings," *Acta Asiatica: Bulletin of the Institute of Eastern Culture*, no. 119, pp. 1–25, 2020.
- [5] S. Cazzoli and C. G. Cereti, "Sealings from Kafir Kala: Preliminary Report," *Ancient Civilizations from Scythia to Siberia*, vol. 11, no. 1–2, pp. 133–164, 2005.
- [6] M. Compareti, "Two Seal Impressions from Kāfer Qal'a (Samarkand) and the Representations of Iranian Divinities," *Journal of Persianate Studies*, vol. 6, pp. 127–142, 2013.
- [7] M. E. Masson, *K voprosu o mestopolozhenii timuridovskogo sada Davlatabad*. Tashkent, Uzbekistan, 1928.
- [8] F. Grenet and É. de la Vaissière, "The Last Days of Panjikent," *Silk Road Art and Archaeology*, vol. 8, pp. 155–196, 2002.
- [9] UNESCO, *Operational Guidelines for the Implementation of the World Heritage Convention*. Paris, France: UNESCO World Heritage Centre, 2023.
- [10] ICOMOS, *International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter)*. Venice, Italy: ICOMOS, 1964.
- [11] ICOMOS, *Charter for the Protection and Management of the Archaeological Heritage*. Lausanne, Switzerland: ICOMOS, 1990.
- [12] Republic of Uzbekistan, *Moddiy madaniy meros obyektlarini muhofaza qilish sohasidagi normativ-huquqiy hujjatlar to'plami*. Tashkent, Uzbekistan, 2019.
- [13] F. Grenet, "Regional Interaction in Central Asia and the Development of Sogdian Urban Culture," *Silk Road Art and Archaeology*, vol. 12, pp. 45–68, 2006.
- [14] B. A. Litvinsky, V. A. Ranov, and A. H. Dani, *History of Civilizations of Central Asia, Vol. III: The Crossroads of Civilizations: A.D. 250–750*. Paris, France: UNESCO Publishing, 1996.
- [15] Y. A. Zadneprovskiy, "Fortified Settlements and Defensive Architecture of Ancient Sogdiana," *Archaeology, Ethnology and Anthropology of Eurasia*, vol. 29, no. 1, pp. 74–86, 2007.