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Enhancing The Criteria for Ensuring the Structural Stability of Khiva's Minarets

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Abstract: In this article, the methods of construction of minarets of Khiva, architectural composition, building materials, history of construction, devices of aboveground and underground parts, which are of special importance in the ancient Khorezm architecture, are described in scientific sequence and in-depth analysis for the first time. Much of this information is being inserted into scientific circulation for the first time.

Keywords: Architectural monument, minaret, basement, lantern, construction material, spiral, mezzanine, lantern, staircase, earthquake resistant.

INTRODUCTION

Ancient monuments in Eastern cities cannot be imagined without minarets. Minarets, as is well known, were constructed in connection with the spread of Islam in our region. Beside every large or small mosque, a minaret was inevitably built, from which the muezzin called Muslims to prayer five times a day. Tall minarets also served as landmarks for caravans approaching the city (Figure 1).

Most importantly, as the great military leader Amir Timur famously stated: "Бизнинг қудратимизга шак келтирган киши биз қурдирган иморатларга боқсин", "If anyone doubts our power, let them look at the buildings we have constructed." Indeed, the construction of towering minarets symbolized the status of the state and demonstrated the strength and authority of its rulers. Over time, these structures began to be built for additional purposes as well. Minarets are also architectural monuments that enhance the grandeur and magnificence of traditional Eastern monuments crowned with azure domes.

Figure 1. Minarets of the Ichan-Qala Museum-Reserve, Khiva City

Minarets are considered to be among the tallest structures of the Middle Ages. The term “minaret” originates from the Arabic word “manāra”, which literally means “a place from which the call to prayer is made.” The construction of minarets became widespread in Central Asia following the Arab conquest; however, minarets also existed prior to the advent of Islam. In his work “Osor al-baqiya”, Al-Beruniy provides information about the minarets of the Afrighids [2].

Minarets historically served three main functions: the call to prayer, observation and surveillance, and orientation or landmark guidance. Minarets built before the spread of Islam were primarily intended for observation, control, and wayfinding. From this perspective, minarets may be classified as state structures (observation and surveillance), public structures (orientation and landmark functions), and religious buildings (the call to prayer).

Khiva, one of the most ancient cities in the world, is internationally renowned for its architectural heritage. Thousands of tourists from across the globe visit the city each year to admire its unique architectural monuments. Khiva is a remarkable city rich in towering minarets, azure domes, and ornate historical structures. Observing these monuments, one cannot help but admire the exceptional artistry and craftsmanship of the master architects and creators who built them.

Each architectural monument in Khiva is the product of a specific historical period and reflects the culture, environment, and the level of scientific and technological development of its time. The fact that these architectural monuments have survived for centuries up to the present day testifies to the exceptional craftsmanship of the builders and the high quality of construction achieved during that era.

It is widely recognized that among the historic cities of our country, very few possess a number of minarets with such distinctive structural designs as those found in Khiva. Even in cities where minarets still exist, their number rarely exceeds three or four, while in some ancient cities no minarets have been preserved at all.

“Khiva is, indeed, the city of minarets!” In ancient Khwarezm, hundreds of minarets were constructed, and of these, 16 have survived to the present day, preserved within Ichan-Qala and Dushon-Qala. However, reliable information about the actual heights of these minarets is very limited, and the data that exists varies across different sources.

For example, the Islom Khoja Minaret, considered the tallest minaret in Central Asia, lacks a consistent height measurement in the literature. In A. Mankovskaya’s book “Памятники зодчества Хорезма”, (Architectural Monuments of Khwarezmits) height is reported as 56 meters, while in A. Abdurasulov’s “Khiva”, it is listed as 44 meters. Other sources also fail to provide any calculations or verified measurements based on solid evidence [1, 3].

In scholarly research, the engineering methods used in the restoration of minarets—structures of great importance in ancient Khwarezm architecture—have not been specifically studied. The minarets of Khiva have been examined by V. L. Voronin, V. Bulatov, and I. I. Notkin as part of the general architectural ensemble. However, these studies provide limited insights from the perspective of structural design and seismic resistance. Most importantly, the underground components of these minarets—their foundations and bases—have not been investigated [4].

This gap, in turn, necessitates a rigorous scientific study of the unknown principles, traditional methods, and construction norms involved in restoring ancient minarets. Notably, such research has not been conducted not only on the minarets of Khiva but also on the majority of existing minarets in the country. There is currently no scientific data regarding how the underground parts, including the foundations and substructures, were originally constructed or have endured through the centuries.

In Khiva, no comprehensive experimental studies have been conducted to assess the current technical condition of historical minarets, including both their underground and above-ground structures, for the purposes of preservation and extending their lifespan. Additionally, no “Database” has been created to facilitate the conservation, maintenance, and efficient use of these ancient minarets, nor have “Technical Passports” been developed in accordance with architectural and engineering standards.

Scientific recommendations for monitoring the aging of minarets over time, performing repairs, and protecting them from various adverse impacts have also not been formulated. This highlights a significant gap in the systematic study and management of these historic architectural monuments.

Materials on this topic have been covered by various authors at different times, often presenting contradictory or inconsistent information, particularly in recent textbooks, manuals, and scholarly articles. Due to the lack of substantiated scientific results regarding the minarets of Khiva, several challenges arise in the preservation,

restoration, and use of the existing minarets within the Ichan-Qala Museum-Reserve under UNESCO protection and in the Dushon-Qala area.

The discussions and observations shared among the public further strengthened our interest as researchers in studying the foundations of these minarets. Recognizing this as one of the urgent tasks that cannot be postponed, we have undertaken systematic scientific research in this area (Figure 2).

Currently, under the grant project IJ.5-18, titled "Жаҳонга машҳур Хива минораларининг барқарорлигини таъминлаш мезонларини такомиллаштириш" "Enhancing the Criteria for Ensuring the Structural Stability of the World-Famous Minarets of Khiva", funded by the Fundamental Research Support Fund of the Academy of Sciences of the Republic of Uzbekistan, comprehensive experimental studies are being conducted in Khiva. These studies aim to assess the current technical condition of historical minarets (including both their underground and above-ground structures) for the purpose of their preservation and extending their lifespan.

Figure 2. General view of Khiva minarets of various dimensions being studied, including the underground and above-ground structures: "Chilla Avliyo Minaret," "Polvon Qoriy Minaret," and "Rahmonberdibiy Minaret"

Within the framework of this project, for the first time, the construction methods of Khiva minarets—structures of particular importance in ancient Khwarezm architecture—are being systematically studied. The research provides a detailed scientific analysis of their architectural composition, building materials, construction history, and the design of both above-ground and underground components.

The study examines the necessity, general principles, harmony, and distinctive features of restoring minarets in the formation of historic urban centers. Currently, a "Database" is being created to enhance the efficiency of preservation, protection, repair, and use of these minarets, and "Technical Passports" are being developed in accordance with architectural and engineering standards.

Conclusion

In conclusion, the scientific research conducted and the results obtained under this project provide a solid foundation for preparing scientifically-based preservation and restoration plans for the minarets of Khiva. Most importantly, this work contributes to passing on the spiritual and material heritage of ancient Khiva minarets to future generations and supports the development of international tourism in the region.

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