



DESCRIPTION OF THE INNOVATIVE DATABASE CREATED FOR THE FIRST TIME ON KHIVA MINARETS AND RESULTS OF PRACTICAL RESEARCH

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<https://doi.org/10.5281/zenodo.18050664>

ARTICLE INFO

Received: 22nd December 2025

Accepted: 23rd December 2025

Online: 24th December 2025

KEYWORDS

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ABSTRACT

As a result of monitoring conducted by staff of the Ma'mun Khorezm Academy's "Laboratory for Testing and Restoration of Construction Materials of Historical and Architectural Monuments of the Southern Aral Sea Region" in the underground and above-ground structures of the ancient minarets of Khiva city, including the Bikajan Bika Madrasa and Sheikh Mavlonjon Bolbukhon, an innovative database on the technical condition of the minarets has been formed, and based on this, practical work is being carried out to create 3D objects using the modern AutoCAD program with the 3D Max program

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In forming the first innovative databases on Khiva minarets, in-depth analyses are being conducted with a scientific approach to the construction methods of the minarets, their architectural composition, construction materials, construction history, and underground and above-ground structures. In particular, scientific researchers and doctoral students of the Khorezm Ma'mun Academy are studying the general patterns of restoring ancient minarets and the characteristics of various indicators on the scientific topic "Developing criteria for ensuring the stability of the world-famous Khiva minarets," and the general patterns of reconstructing ancient minarets and the characteristics of various indicators are being studied.

To date, 94 historical and architectural monuments have been registered and taken under state protection in the territory of Khiva city¹. Various forms of deformation have appeared in their underground and above-ground parts to this day. The main causes of deformation in the monuments are considered to be the following: unfavorable climatic conditions in the region (Southern Aral Sea Region), salinization, water leakage from irrigation and communications,

¹ Ўзбекистон Республикаси Вазирлар Маҳкамасининг 2019 йил 4 октябрдаги 846-сон "Моддий маданий мероснинг қўчмас мулк объектлари миллий рўйхатини тасдиқлаш тўғрисида"ги қарори

rising groundwater levels due to rainwater flowing under foundations, that is, a sharp deterioration of the geological-ecological situation in the region.

On the other hand, methods for studying and evaluating historical monuments characterized by complex systems and distinguished by multi-level connections have not been developed, that is, their condition depends not only on the strength of the soil base, but also on the behavior of pedestals and foundations, as well as on the structure of buildings under technogenic load.

According to the current climate map developed by German-Russian climatologists Vladimir Köppen and Rudolf Geiger (1991-2020), Khorezm province and Khiva city have a climate characteristic of the second, namely arid, zone.

The main cause of groundwater levels and soil salinization in Khorezm is large-scale irrigation. The agricultural irrigation system in the province began to be applied from the 1960s. Agricultural lands are irrigated using the waters of the Amu Darya. In agriculture, drainage systems for collecting groundwater return the water to the river, which has become the source of that water, leading to a decrease in river water quality. Currently, most saline soils and saline waters are located in the lower reaches of the Amu Darya and Syr Darya basins, and salinization is considered one of the main threats to food production. Due to insufficient demand and supply for deep drainage systems and inadequate provision of irrigation and drainage networks, water salinity continues to increase².

During research conducted at the Ichan Kala Museum Reserve, we observed the presence of various marble-made gutters intended for draining rainwater and sewage to the general sewerage system in the interior and exterior parts of most architectural monuments. Unfortunately, due to negative technogenic impacts from human activities and during repair processes, most gutters have been blocked.

Based on conclusions about the Saidniyoz Sholikorboy complex minaret coming into an emergency state from negative technogenic impacts, relevant organizations were contacted (2010-2012). Under the control of the Khiva district administration and the Department of Internal Affairs, iron gratings were installed on 2 sides of the monument and traffic was stopped. As a result of these practical measures, it was possible to stop the deformation process of the monument's minaret.

Regarding the database (DB) of Khiva minarets - this is a collection of structured information in a specific subject area. A database (DB) is information organized in the form of records with elements and a uniform structure.

Research work on the conveniences and advantages of creating an innovative database on Khiva minarets is of great importance in the fields of heritage preservation, architecture, and restoration.

- Centralized data resource: By collecting all information about minarets, mosques, and other architectural monuments in Khiva in one place, there is no need for researchers, restorers, and government officials to search separately for information about each minaret in the area, thereby saving time.

² Kijne, J.W., 2005. Aral Sea Basin Initiative: Towards a Strategy for Feasible Investment in Drainage for the Aral Sea Basin. Synthesis Report, IPTRID-FAO, Rome, Italy.

- Through digitalization, by entering visual information of each minaret in 2D and 3D forms (for example, AutoCAD, 3DS Max, photogrammetry), architects and engineers can work with precise measurements. This makes it easier to compare the historical and current state of the building, and 3D models are used for virtual tours, education, and VR environments.

- Regarding search and sorting capabilities, the ability to filter in the database, search by line, sort by minaret name, location, history, condition, and other features increases. A researcher or specialist can quickly find existing data, which helps in making effective decisions.

- Through the user interface, the database can be used through a web application or desktop platform, for example:

HTML5/JavaScript-based interactive maps QR code identification - access to online data with a specific QR code assigned to each object. This allows creating a very simple and intuitive interface for tourists, students, and researchers.

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