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Repair and Restoration of Architectural Monuments

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Abstract

This article discusses the repair and restoration of architectural monuments. The tasks of applying new developments to restore the bearing capacity of building structures and the use of modern composite materials become topical. Innovative developments in the field of restoration are a specific form of managing the development of construction processes and technologies that allow for a comprehensive change in the structure, organization and content of the reconstruction process as a whole. The use of such developments makes it possible to solve complex problems of preventing destruction and giving historical uniqueness to architectural monuments of world importance.

Keywords: scientific restoration, modern achievements, new technologies, restoration, scientific data, innovative developments, architectural monument

INTRODUCTION

Scientific restoration, as well as the conservation of an architectural monument or an archeological object, is associated with maintaining the historical appearance of a structure and preventing its further destruction. Such work requires individual approaches with preliminary comprehensive monitoring, different from approaches to constructive solutions.

Measures to protect the building from destruction are divided into operational and construction. As operational measures, waterproofing, impervious curtains, and various designs of drainage are used. Construction restoration measures include: replacement of internal structures and floors, dewatering, to create conditions that allow underground work.

During the reconstruction of architectural monuments, earthworks are usually carried out in cramped conditions, where the use of the latest technologies and methods speeds up and simplifies the restoration work. For the foundations of a reconstructed building, traditional methods are used to

strengthen soils by thermal, chemical or physical-mechanical methods. The choice of strengthening method depends on the type of soil and additional loads on the building.

In order to restore horizontal waterproofing during the reconstruction of a building, diffusion impregnation, injection, surface impregnation, the installation of sanitizing insulating tapes, and the use of plaster systems in several layers based on organosilicon and mineral compositions are widely used. Recently, in Uzbekistan, various silicon-based water repellents have proven themselves well. Durability, elasticity, and good compatibility of the material with structural elements, provides high protection and reliable preservation for a long period of operation.

To select the method of strengthening and restoring the foundation, it is necessary to analyze the causes of its destruction. In order to eliminate delamination in the foundation masonry, the injection method has traditionally been used. To increase the bearing capacity, reinforced concrete clips, bored and bored injection piles are arranged in the foundation, silicification, itemizations, and racemization are carried out. The increased load on the foundations is eliminated by redistributing it with the help of metal belts. Due to the loss of bearing capacity and severe wear of the foundation, it is allowed to change its structural scheme by embedding additional supports, buttresses or new slabs.

Current trends in the development of scientific restoration in Uzbekistan, as well as reconstruction technologies, are directly dependent on innovative developments. A new method of strengthening the foundations used today in Uzbekistan is a combined one. It is based on the use of a high-pressure water-air jet: a fixing solution of cement or resin, together with air, enters the soil. Numerous tests of the method of water-air jet have confirmed its high efficiency in the process of work on strengthening the base. This makes it possible to use this method effectively in the reconstruction and scientific restoration of architectural monuments.

Thus, foundations and foundations can be strengthened in the following ways: by laying existing foundations and laying new foundations, by strengthening structures, by using various methods of chemical soil stabilization, and by injection piles.

In the process of long-term operation, the enclosing structures of historical objects are exposed to many negative factors. In addition to the enclosing and bearing capacity, the walls should help maintain the required level of sound and heat insulation and humidity conditions in the room. In the case of various deviations and deformations, they are restored with straightening steel frames or reinforced with screeds. Particularly deformed and damaged sections of structures can be replaced.

The lack of the degree of sound insulation and thermal protection is eliminated as follows: if there are cracks in the walls, they are sealed and reinforced, then the external walls are thermally insulated. The most effective way is to use “wet” type décor systems, for example, thin-plaster systems. These materials are non-combustible, durable and suitable for wall decoration with the most complex architectural elements. And problems such as damp walls are eliminated by waterproofing the walls from the outside.

The floor structures of the majority of historical buildings are wooden, and without repair they can be used for no more than 60 years. The cost of restoration and replacement of floors is approximately 20% of the total cost of modernization. The most expedient is the replacement of wooden floors with reinforced concrete ones if they are significantly destroyed, and the walls of the building are in satisfactory condition. In the case when the floors, walls and foundations of the building are badly damaged, the floors are reinforced or restored with partial replacement of steel and wooden structure elements with new ones. To reinforce floors, the following methods are traditionally

used: unloading structures, including new structural elements of the floor, changing the design scheme of the historical floor.

The latest innovative developments include the use of systems based on fiber-reinforced polymer composite material. Such materials have proven themselves in cases where the bearing capacity of structures is insufficient and it is required to make reinforcement without weighting and significant changes in the geometry. The system of composite materials includes materials based on carbon, aramid and basalt fiberglass.

In buildings that are architectural monuments, there is often no properly arranged ventilation system. To ensure it, the combined roof is converted into an attic. If such a decision may affect the change in the historical appearance of the reconstructed building, it is recommended to rebuild the non-ventilated roof into a ventilated one. High-quality thermal insulation of the roof allows you to protect the historic building from environmental influences and extend its service life. It is worth giving preference to lightweight, non-combustible, durable materials that have high thermal insulation properties and are easy to install.

The main goal of scientific restoration is not only the preservation of the historically significant appearance of the building, but also the possibility of its operation in the conditions of life of a modern city. New developments in the field of equipment and materials contribute not only to extending the life of a historical building, but also to avoid additional costs for re-repair, which once again should not be subjected to an architectural monument.

Today, all over the world, technologies and building materials related to energy saving, the use of secondary raw materials and man-made waste have become the most popular. The basis for the development of innovative activity in the field of reconstruction should be: the use of new technology and technological processes for ensuring production; introduction of products with new properties; use of new raw materials; changes in the organization of production and its logistics.

With regard to the conservation of an architectural monument, it is necessary to consider the main methods of preserving historical structures in their original form that has come down to us. The main stage in the conservation of historical structures is the preservation of the load-bearing elements of the structure and facades. Let us consider the stabilization of masonry as the basis for such a restoration.

If there are no time-tested methods for the structural strengthening of the stone, then imparting solidity to the masonry by injecting stabilizing solutions into its cracks can be carried out on the basis of the developed technology and extensive studies of binders. Injection achieves significant cost savings and ensures the strength of the original masonry not only during conservation, but also during restoration and reconstruction. The selection of the composition of the mortar for reinforcing stone, in particular brickwork, by injection depends on the structure of the wall, on the conditions in which this masonry will be located, and, finally, on the presence of architectural décor on its surface.

Injection is carried out after the preliminary elimination of the causes that caused the cracks, otherwise the masonry will be torn again in another place with new precipitation. Often, after the elimination of the causes that caused the deformation, it is necessary to make an interval to stabilize the position of the structures. When the bonds are broken, the injection of cracks is carried out after installing them again or installing buttresses and after strengthening the vaults themselves by caulking large gaps with a semi-dry mortar (after hardening). In some cases, when increasing deformations threaten to fall out of individual parts of the masonry, it is necessary to carry out preliminary injection

work along with the caulking of open seams, taking into account the fact that after stabilization of the structure, these works will have to be repeated.

The requirements for stabilizing solutions during the conservation of architectural monuments are much broader than those that apply to the strengthening of engineering structures. To strengthen the masonry of ancient architectural objects, the following requirements are imposed on mortars:

- the ability to penetrate into small cracks, not delaminate in the seams and wide cavities of the masonry;

- after hardening and drying, have good adhesion to the masonry with slight shrinkage;

- minimize the formation of efflorescence on the surface of the masonry and exclude the harmful effect of the injection on the wall painting. The injection of masonry should not leave noticeable marks on its surface;

- be close in physical properties to the reinforced masonry.

In scientific restoration, the principle of least intervention implies that minimal changes are made, which ensures the preservation of the authenticity of the monument. The principle of reversibility ensures the restoration of characteristic elements using materials as close as possible to the original, which, if necessary, can be removed without compromising the historical state of the monument. The key to the success of restoration work is the most complete, detailed study of the object. In addition to the degree of deterioration of the building and the amount of work to be done, the influence of the environment and nearby objects that affect the preservation of an architectural monument is taken into account.

So, the main result of the development of restoration in Uzbekistan in the XX – early XXI century was the development of the principles of scientific restoration. They were based on an archaeological concept, the practical basis of which was the concept of a monument and the problem of its preservation.

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