Features of the building materials use in architectural and urban heritage restoration

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Abstract. The article is devoted to the study of the building materials use principles in the restoration of monuments of architectural and town-planning heritage. The basic properties of the materials, classification and specificity of their use are indicated. As a result of the analysis, the most important role of the material in the formation of the architectural image of the object was substantiated. It is concluded that the material should be considered not only in the context of technical parameters, but also in terms of architectural and artistic characteristics. Attention is focused on the object authenticity meaning understanding and on the operational properties of the materials for decoration. It was noted that the choice of the materials should occur on the basis of the preceding stage of the material research, as a segment of a detailed survey of the technical state of the structure.

Introduction
Sustainable development of the state is impossible without preserving the national-cultural traditions of the people, having been formed throughout the history. Each nation inhabiting a certain part of the territory, introduced its traditions and customs in the culture of the region, forming a single unique cultural system of the state. It is necessary to emphasize that the basis of traditions is the historical and cultural heritage, which includes monuments of architecture and urban planning. These monuments are not only significant material reality, in particular, the real estate objects, but also spiritual - a valuable inner world of a person, its special “genetic code”. At the same time, building materials occupy an important place in solving the issues of conservation and restoration of the architectural and urban planning heritage. Special attention should be paid to the study of the properties and specificity of the materials, on which the constructive-technological and artistic-aesthetic foundations essentially depend as to the immutable postulates on the restoration of architectural and town-planning monuments. However, despite the presence of a large number of theoretical and practical works in the field of preservation and restoration of these monuments, the question of choosing this or that material for the restoration or renewal of the original parts of the architectural object still remains relevant.

Purpose, objectives, research methods
The purpose of the study is to identify the features of the materials used in the restoration of objects of architectural and urban planning heritage, as well as in buildings and structures demonstrating artistic value as objects of the background historical buildings.

To solve this goal, the following research tasks are defined:
to show the range of materials and conduct a comparative analysis for their use in the restoration of architecture monuments and urban planning;

to determine the priority advantages of the materials, the most relevant to those from which the object of architectural and town-planning heritage was originally erected.

The object of the study is the monuments of architecture and urban planning, studied as an object of restoration.

The subject of the research is the relationship of the characteristics of building materials and the architectural image of the object.

Research methods include an integrated approach, namely, system and comparative analysis in correlation with architectural, historical and historical and town planning analyzes. The study is also based on theoretical modeling.

**Conceptual basis for the restoration of the architectural and urban heritage**

Considering the use of building materials in the monuments of the architectural and town-planning heritage, the use of such concepts as “preservation of the cultural heritage object” and “restoration” is legitimate.

Preservation of an object of cultural heritage is revealed in measures aimed at ensuring physical security and preserving the historical and cultural value of an object of cultural heritage (paragraph 1 of article 40 of Federal Law No. 73-FL "On objects of cultural heritage (historical and cultural monuments) of the peoples of the Russian Federation” in terms of the Federal Law of 22.10.2014 No. 315-FL).

Restoration is understood as strengthening and restoration of monuments of history, culture and art damaged or destroyed by time, destructive or inept impacts ... Before the restoration the materials and technology for creating a monument, causes and types of its destruction, its original appearance are found out, using physical and chemical methods, analyzes, photographing, as well as with the help of historical data (written sources, pictorial materials, stylistic analysis). During the restoration, the structure of the monument is strengthened with the use of the materials similar to the original one [1].

Taking into account the fact that during the restoration of the object of architectural and town planning heritage it is necessary to preserve the authenticity of the artistic image of this object; the choice of appropriate material for strengthening and restoring is extremely important. However, the materials choice should not represent a set of only aesthetic, technical and operational characteristics in the gap from the architecture of the object being restored.

When considering the authenticity of a building, a number of factors should be taken into account (Figure 1) [2].

Consequently, it is necessary to focus on the three main components of the concept of “authenticity of the architectural and town-planning heritage”:

- authenticity (great heritage value in the authenticity of the material, technology, function);
- compliance with the original form (for example, compliance with the compositionally-completed architectural appearance of the object);
- originality (uniqueness and sophistication in a particular style, in terms of architecture). At the same time, “determining the value of heritage is an important part in the decision to restore this object” [3].

However, at the same time, historical significance is one of the criteria for determining authenticity. In this regard, one should also pay attention to objects of historical and architectural value, regardless of the fact that objects located in the historical environment do not have the status of a monument. In some cases, these buildings or structures belong to the outstanding examples of a certain historical era in which they were built and, along with the monuments of architectural and town planning heritage, play an important role in the preserved urban spatial environment in the ensembles of a historic urban or rural settlement. These objects “indicate a high level of cultural development, can tell about the events that occurred” [4] in a particular area of the settlement.
Figure 1. Authenticity of a building

The practice of the recent decades has clearly shown the tremendous importance of restoration works for monuments of history, culture and art. Along with the further development of the most important and direct function of restoration - preservation and restoration of architectural monuments ... - the importance of restoration works for the study, scientific study of the monument as a historical and artistic phenomenon increases. Restoration practice opens up the widest possibilities [5].

Characteristics of the materials used in the restoration of objects of architectural and urban heritage

The initial stage preceding the restoration is a survey of the architectural object and town planning for the technical condition of the structures, including their ability to withstand the load, creating conditions for the normal functioning of the product and determining the causes of damage not only for the whole object, but also for details of this or that material. The definition of the morphology of a building material - an aggregate characteristic, which includes the structure, size, shape, etc., necessary for constructive and restoration activity is of particular importance. “The situation requires a balanced approach to take targeted comprehensive measures” [6] on the restoration of architectural and urban monuments.

At present, the modern trends in the field of preservation of historical and cultural heritage contribute to significant attention to the study of the properties of building materials used for the restoration of architectural and urban heritage. The world of building materials used in the restoration of this heritage is multifaceted. A prominent position in this regard is occupied by traditional materials, such as: natural stone (natural material), brick and ceramic products, wood, gypsum, etc. Despite the impressive product range, stone and ceramic materials have a rich, centuries-old tradition, are among the most sought-after restoration and therefore it is worthwhile to emphasize them separately.

So, natural stone has a natural beauty, while possessing a wide variety of colors and textures, and a brick being an artificial material, in most cases has the properties of a stone, strength, frost resistance,
etc. Choice of an identical brick for the restoration implementation is not always possible, however, the manufacture of appropriate bricks for individual orders will help in solving this problem.

Natural ceramic tile is a versatile and reliable roofing material created by sintering natural ingredients. Natural tile resists the entire range of atmospheric factors: it is not susceptible to burning, tolerates temperature changes, is waterproof and visually always individual. The tile does not emit harmful substances, does not require painting with artificial dyes, and is safe for health and the environment [7].

When choosing a material for the restoration of a monument of architectural and town planning heritage, special attention should be paid to the color of the material. The color change of the selected building material is often associated with the spectral composition of the light sources. It is a common misconception that the color makes it possible to hide poor quality during the finishing restoration works. This judgment is potentially unacceptable and dangerous, as it creates a threat to the architectural appearance.

A wide practice shows that the color not only does not mask the defects of the builders, but on the contrary exposes them. Color has always been a powerful means of organizing space, it complemented or emphasized tectonic elements of architecture ... The texture of ceramics is no less important than the color, which helps to reveal the constructive role of one or another part of the building. So, the “rough” texture in the form of large-sized brick rust or bricks with a surface under crushed stone is most often used for finishing massive, bearing parts of the building - bases, pylons, retaining walls. A rough or matte texture is used to finish the walls of overlying floors, walls, corners, cornices. Glossy surfaces are suitable for small inserts, framing textured or color spots [8].

Therefore, before using these or other facial bricks, ceramic stones in the restoration of monuments of architecture and urban planning, you must correctly justify your choice. Take into account their technical and operational and decorative qualities, as well as compliance with the architectural and construction requirements of the object being restored (Figure 2).

![Figure 2. The qualities that face bricks and ceramic stones should have](image)

**Summary**

Thus, when using materials in the restoration of the architectural and town-planning heritage it is necessary to take into account their main advantages and disadvantages, in particular, the architectural, art qualities and distinctive features from other materials that have the same basic characteristics. It is
natural that the preference is given to those materials that reflect the authenticity of the original material in the objects being restored as much as possible. However, ignoring or underestimating the aesthetic and technical characteristics of the materials used can lead to negative results of the restoration and have a negative impact on the carrying capacity and functional suitability of the object’s structures.

Numerous observations of the monuments after restoration and the collected data on the increasing negative results of restoration measures show that the existing survey system requires modernization both by itself and in the introduction to the restoration design of a monitoring research system [9]. The restoration should “correspond to the achievements of modern science, be carried out only by highly qualified specialists, while preserving the original architectural appearance of the structure as much as possible” [10].

References
[1] Ivyanskaya-Hessen I S 2008 Russian-English architectural dictionary (Astrel: AST, Moscow).
[2] Subbotin O S, Bondarenko S A 2018 The role of material in the restoration of monuments of architectural heritage (News of universities. Building) 6 97-105.
[3] Oliferenko V A, Ustinov I A 2002 The method of determining the historical and cultural value of an object possessing the characteristics of an object of cultural heritage from the point of view of history (Main Directorate for the Preservation of Monuments in Moscow: Journal) 5 23-25.
[4] Subbotin O S 2018 Problems of Reconstruction of the Historical Center of the City (Materials Science Forum) 931 745-749.
[5] Restoration and research of cultural monuments 1975 (Stroyizdat, Moscow).
[6] Subbotin O S 2018 Architectural and Planning Principles of the Organization of Coastal Areas (Materials Science Forum) 931 750-753.
[7] Subbotin O S, Bondarenko S A 2016 Innovations in architecture and construction (on the example of the Krasnodar Territory) (studies Allowance, RIF LLC Building Materials, Moscow).
[8] Ginzburg V P 1983 Ceramics in architecture (Stroiizdat, Moscow). (Material in architecture).
[9] Knyazev V P 2005 Ecology. Basics of restoration (Tutorial, Architecture-C, Moscow).
[10] Subbotin O S 2015 The innovative materials in the monuments of the architectural and urban planning heritage of the Kuban (Housing construction) 11 35-40.