The mechanism for managing cultural heritage objects, taking into account the possibilities of the digital environment

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Abstract. The article highlights the problems of exploitation of cultural heritage objects, which characterizes the subject area of the study. The classification of objects of cultural heritage and features of their definition in different countries are presented. The analysis of statistical data on cultural heritage sites in the Russian Federation, including those included in UNESCO, was carried out. The features of management, as well as the problems of monitoring the state of cultural heritage objects are considered. A separate and fundamental issue of management of cultural heritage sites is security activities, which are based on unique models formed by different countries based on their experience. A mechanism for managing cultural heritage objects in a digital environment and a universal conceptual model for introducing digital technologies into the system of real estate operation are proposed. Key words: cultural heritage object, architectural monuments, condition monitoring, operational model of a cultural heritage object, digital technologies, intelligent device control

1 Introduction

The problem of preserving cultural heritage objects (CHO) is one of the most difficult in scientific and practical activities in the construction industry.

The great interest in the issues of conservation of the CHO is primarily due to the threat of loss of the object, associated with a variety of factors of natural decay and various types of destruction of an artificial nature. Another important issue is the effective use of the potential of cultural heritage for the economic and social development of the territories. The above aspects suggest debugging the mechanisms for timely repair and restoration work.

The object of the study is CHO.

The subject of the study, which determines the problem area of the study, is the process of timely implementation of measures for the overhaul or reconstruction of the CHO, preventing the destruction and loss of the object.

The purpose of the study is to improve the mechanism for managing the operation of conservatory objects, taking into account the necessary capital and restoration work in the modern digital environment.

To achieve this goal, the following research tasks were formulated and solved:

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- conduct an analysis of statistical data on CHO;
- to identify problems in the management of the operation of CHO;
- to develop elements of a digital model for predicting measures for the overhaul or reconstruction of CPV, taking into account wear and tear.

OKN is real estate that is historically associated with a certain territory, works of art resulting from historical events that are of particular value.

OKN are of historical value for all mankind and are of great importance in the cultural development of man and the preservation of memory for future generations [1-7]. These include: architectural monuments; natural complexes; works of art; archaeological objects and other objects inherited from the past and of value from a historical point of view. Architectural monuments include separately built (immoveable) buildings and structures that are of particular importance for the culture of the country and its history.

Given the special status and value of such property, the procedure for its involvement and use in civil circulation is regulated by civil law and is subject to special civil law protection.

2 Materials and Methods

Preservation of heritage is the most important condition for the economic development of any state, therefore, there is a need for state regulation in the field of protection, disposal and use of material cultural heritage.

The research is based on the materials of the national and international regulatory framework in the field of urban planning and protection of cultural heritage. The main document is the Convention on the Preservation of the World Cultural Heritage of the XVII session of the General Conference of UNESCO.

The properties of the OKN determine the complex nature of their legal regulation, which includes laws and by-laws of the federal level, and regulatory legal acts of the constituent entities of the Russian Federation. The fundamental document of the national regulatory framework is the Federal Law of June 25, 2002 No. 73-FZ “On objects of cultural heritage (monuments of history and culture) of the peoples of the Russian Federation”.

The public source of statistical information on CHO is the Unified State Register of CHO (USRCHO).

During the research, the following general methods of scientific knowledge were used: methods of empirical research (observation, comparison) and methods of theoretical research (abstraction, analysis and synthesis).

3 Results

The formation of a CHO management mechanism requires the determination of the subjectivity of the bodies and organizations involved in the process of operation and work.

The main function of the protection of cultural monuments in most countries is performed by the ministries of culture (Fig. 1):
Activities for the preservation of cultural monuments are also carried out by specialized state organizations with the participation of public funds.

The main feature of the Russian Federation in the protection of cultural heritage, both in the Soviet Union and at present, is the significant role of the state, which is the main body for financing, maintaining, preserving, restoring the cultural heritage and accounting for objects.

To determine the subjectivity in the management of the CHO, we single out the classification feature of the CHO, which determines the features and principles for ensuring the safety of objects on a global and national basis.

Currently, the cultural heritage includes monuments, ensembles and places of interest that are directly related to the history of society and the state and have historical and cultural value. This fully complies with the Convention on the Protection of the World Cultural and Natural Heritage, adopted in Paris on November 16, 1972 at the 17th session of the General Conference of UNESCO, ratified by Decree of the Presidium of the Supreme Soviet of the USSR of March 9, 1988 No. 8595-XI.

In the legislation of foreign states, two fundamental rights belong to the concept of "monument of history and culture". In the totality of countries, to recognize an object as a monument, it is sufficient to have special, cultural, scientific and other qualities that allow it to be established as a special part of the national heritage (Italy, Germany). In other countries (Great Britain, USA, France), the independent choice of “monument” is not of particular importance for protection even before the object is included in the list of protected uncommon cases of state protection being extended to it [5, 8-10].

Maintenance of registers, catalogs, systematization and inventory of historical monuments and production in all countries. In some of these databases, the computerized activity contains certain data (International law on the protection of historical and cultural heritage URL: http://voopik.ru/our-heritage/practice/international-law/).

The classification of CHO according to the specified Convention is shown in the figure (Fig. 2):
Cultural heritage objects can be tangible and intangible. Also, CHO should be divided into categories of historical and cultural significance (Fig. 3).

The terms “objects of cultural heritage” and “cultural values” used in the legislation are not considered as similar concepts by definition.

The objects of civil rights are not identical and accordingly define historical monuments as a kind of cultural value.

For the first quarter of 2023, in the Russian Federation, according to the USRCHO, there were 444,909 CHO, of which 210,788 are objects of federal significance (2,416 are on the UNESCO list), 224,291 are of regional importance (35 are on the UNESCO list), 9,830 are municipal (3 included in the UNESCO list) (Fig. 4):
The total number of OKN includes the following types of objects:
- 372,760,281 monuments;
- 65,658 ensembles;
- 6,491 places of interest.
In addition, there are identified CHO, but not included in the USRCHO.
The concentration of CHO is higher in the European part of our country, especially for buildings for various purposes.

Below we present statistics on the regions of the Russian Federation leading in the concentration of CHO (Fig. 5):

**Fig. 4.** Distribution of CHO in the Russian Federation by categories of historical and cultural significance.

**Fig. 5.** Number of CHO by regions of the Russian Federation.
Based on the above data, we note that according to the USRCHO, the Republic of Dagestan, St. Petersburg and Moscow have the highest concentration of CHO.

The list of activities, works on historical and cultural monuments in all countries is approximately the same and varies due to the emergence of technical innovations, developments and methods used in a particular country. An approximate list of works includes (Fig. 6):

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<td>1</td>
<td><strong>Pre-design work</strong> (engineering and geodetic surveys, engineering and technical surveys of buildings and structures, architectural and archaeological studies of historical and cultural monuments, historical, archival and bibliographic surveys, attribution of historical and cultural monuments, research of materials and products and etc.).</td>
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<td>2</td>
<td><strong>Design work</strong> (architectural and archaeological research of historical and cultural monuments, development of historical and architectural reference documentation, design of special sections of the project and development of individual methods and technologies for the conservation and protection of monuments, certification of historical and cultural monuments, etc.).</td>
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<td>3</td>
<td><strong>Performance of repair and restoration, conservation and restoration works, including general construction</strong> (archaeological (if there is an “open sheet”) and earthworks in the area of monuments, restoration, reconstruction and strengthening of foundations, production of restoration and conservation structures and materials, etc.).</td>
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<td>4</td>
<td><strong>Other works and services</strong> (examination of project documentation, examination of documents for territorial licensing centers for historical and cultural monuments, regulatory research work in the field of protection and restoration of historical and cultural monuments, technical supervision, scientific guidance, etc.)</td>
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<td>5</td>
<td><strong>Solving issues related to the ownership of monuments of history and culture.</strong></td>
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**Fig. 6.** List of construction works at CHO.

In view of the fact that the CHO is always unique, these steps do not take into account the specifics that determine the complexity and duration of the work.

During operation, the management company carries out the work that is presented in the mechanism for the operation of the CHO (Fig. 7):
This mechanism presents the main types of work carried out by the managing organization.

In the modern context, there is a need and the possibility of introducing digital technologies for managing the operation of CHOs, which allow real-time assessment of the level of depreciation of objects, timely detection of problems, forecasting depreciation of objects and effectively planning the financing of work on CHOs. The issue of object digitization makes it possible to consider the management of ICU in the context of the theory and concept of life cycle assessment. The main directions of digitalization were taken into account when developing a conceptual model for the introduction of digital technology in the management of the operation of CHO (Fig. 8):
This model describes the digitalization block, the process of preparation and implementation.

The digitalization block is a description of the actions of the Management Company to obtain an operational model of a cultural heritage object, as well as the process of preparing such a model by the contractor through the use of laser scanning technologies for buildings to accurately determine the point cloud from which a 3D model is created.

Laser scanning is performed to achieve the following goals:
- determination of the volumes of materials from the dismantling of buildings and structures;
- execution of high-precision dimensional drawings of the facility as part of the technical inspection of building structures;
- creation of a three-dimensional information model for further design based on it;
- creation of orthophotomaps of facades and interior elements for the purpose of their further restoration, and all necessary approvals;
- creation of architectural and archaeological measurement drawings in accordance with GOST R 56905-2016;
- creation of an information model of the object "as built" and its comparison with the design model;
- obtaining three-dimensional panoramas for performing linear measurements on them without leaving employees to a remote site.

The advantages of laser scanning over traditional measurements are as follows:
- faster (up to 3-5 thousand square meters per day);
- in more detail (the entire space is measured: structures, communications, infrastructure elements, losses and defects);
- universality (data transfer to all design environments);
- providing the maximum amount of reliable data about the object of restoration to all specialists involved in the design process.

At the execution stage of the executive model, all the necessary attribute data is entered into it:
- what elements of the building constitute the subject of protection;
- material of load-bearing and enclosing structures;
- types of finishing materials;
- percentage of loss of architectural decorations, etc.

Special equipment - a 3D laser scanner in the form of a complex on a tripod - takes points from the facade, and then builds a three-dimensional model based on them, a detailed drawing, one might say, a digital twin of the building [10].

Laser scanning in the course of work and comparison of the point cloud with a consolidated BIM model gives full control over the implementation of restoration work in real time.

Work progress control and architectural supervision is carried out in the Common Data Environment (CDE).

Upon receipt of a finished operational model from the design organization, all participants in the process of repair and restoration work can exercise control using the common data environment.

4 Discussion

In view of the lack of open data on the level of deterioration of CHO and information on their retirement from operation, the main opinion can be formed on the basis of assessments of the expert professional community [11-15]. According to the opinion of a large number of experts, there is a steady decline in the cultural wealth of our country. According to various estimates, the state of 50 to 70% of the historical and cultural monuments under state protection is characterized as unsatisfactory, for most of them it is necessary to take urgent measures to save them from destruction, damage and destruction.

An important issue of the organizational procedure for the preservation of CHO is the updating and supplementing of information on the state of objects in the state register.

The owner of CHO, who has the right of ownership, is guided primarily by civil law with the features provided for by special legislation on CHO.

To ensure proper protection of CHO, sufficient funding is needed, which the state is not always able to provide.

In this case, the direct owners of the CHO should be granted the right to receive economic benefits from the use of the CHO, including the implementation of commercial activities that can provide additional funding.
One of the most important tasks of the state is to ensure the safety of CHO. However, the territories where immovable CHOs are located are also in need of civil law protection.

5 Conclusions

The analysis of statistical data on CHO shows the annual update of information on the quantitative composition of objects in connection with: disposal (demolition) and the introduction of new objects into the USRCHO. The number of CHOs in USRCHO is growing every year.

Activities in the field of preservation of cultural heritage objects are of particular importance for the state and society, as well as in determining the direction of development of state policy and the goals of the activities of public authorities.

The study identified the following issues in the management of the operation of residential ICH:
- restrictions on the participation of regional operators in carrying out restoration work at the objects of the CHO;
- the problem of financing;
- the problem of fulfilling the requirements of security obligations;
- the problem is in the estimated rationing for repair and restoration work.

The analysis of the regulatory and legal framework for the management of the operation of the CPV has been carried out.

The mechanism of operation of the control of the CHO is described.

A conceptual model for the effective management of the operation of CHO in the context of digitalization has been developed and the main stages of the introduction of innovative technology for the creation and use of an operational digital model of a building have been described. The use of digital technologies can become the basis for assessing the predicted state of the facility in terms of wear and tear, and it is timely planned to finance the necessary amount of repair, restoration and restoration work.

The study will continue with a survey of the expert community on the problems of digitalizing the operational model and determining the initial data for building a neural network when predicting a set of CHO data (operational characteristics) and risks at all stages of the life cycle of an object.

References


