Security systems in buildings and structures of museum complexes

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Abstract. This study is aimed at analyzing the museums of the Rostov region and identifying the main approaches to the design of museums. Particular attention is paid to ensuring security in museums. The article proposes a comprehensive concept of museum security.

1. Introduction
Today we can talk about the flourishing of the museum business. The role of the museum begins to increase, more and more interested people come to the museum. The creation of museums in the region is an indicator of the development of the self-awareness of society. Through the museum one of the most important needs of society is realized in preserving the memory of its history, of its heritage.

Each museum should have an individual architectural and artistic solution, determined by a specific collection and forms of activity. A feature of all museums is a constant increase in the number of exhibits, replenishment and renewal of compositions. In accordance with this, for museums, rationing similar to standard design objects cannot be proposed. The purpose of the article is to form the basic principles of museum design taking into account security.

When opening new museums or renovating existing ones, one should proceed from the need to create an integral interconnected museum and exhibition system in the region, including museums of various profiles, exhibition halls, historical and cultural monuments and contributing to the most effective and comprehensive display of history, nature, social development, art, and as well as modern achievements in socio-economic and spiritual life. In this regard, it seems appropriate to create centralized storage facilities with laboratories and workshops and the priority development of a network of specialized museums.

The relevance of museum security issues is dictated by the modern rhythm of life, the complex geopolitical situation and scientific and technological progress in general. The problems of safety and security are the most important in the system of functioning and development of any business entity, regardless of the organizational and legal form of the enterprise and the nature of its activities. They are also relevant for museums and exhibition complexes. Advances in science and technology, universal computerization have led to the emergence of new directions in the development of security systems, contributed to the modernization of traditional areas of protection. The problems of ensuring the safety of collections have always been key in the activities of cultural institutions, and now they have acquired paramount importance for them. The main task in the conditions of increased crime risk, constantly growing demand for works of art stored in museums in the country is their preservation and protection from various factors that contribute to damage or irreparable loss of collection items. The construction of an effective security system in museum institutions is impossible without an integrated approach to solving the problem, taking into account all aspects of the problem.
including taking into account the maximum possible threats to the security of their detection, prevention and adequate response to these threats. When developing general principles for building security systems, it is necessary to take into account the characteristics of each specific museum institution. These features can be taken into account using the appropriate classifications and models of museum institutions.

2. Materials and methods
The works of the following authors are devoted to the design of museums: F. Fathy, Y. Mansour, H. Sabry, M. Refat, A. Wagdy, 2020 [1], C. Fenu, F. Pittarello, 2018 [2], B. I. Farahat, K.A. Osman, 2018 [3], X. Luo, P. Song, Y. Wang, W. Tian, Z. Gu, 2016 [4], M. Napp, T. Kalamees, T. Tark, E. Arumägi, 2016 [5], J. Pallud, DW Straub, 2014 [6].

The issues of ensuring various types of security in museums are reflected in the works of such authors as: AC Li, CM Shu, YT Teng, TS Shen, PP Hsieh, 2018 [7], G. Litti, A. Audenaert, K. Fabbri, 2018 [8], S. Marcotte, L. Estel, S. Minchin, S. Leboucher, S. Le Meur, 2017 [9].

On the other hand, the features of innovation in the tourism and hospitality industries were studied, reflected in the works of: N.A. Zaitseva, I.V. Goncharova, M.E. Androsenko (2016) [10], N.Y. Goryushkina, D.V. Shkurkin, A.S. Petenko, S.Y. Demin, N.S. Varovaya 2016 [11], S. Wang, K.Hung 2015 [12], Ivanov V., Popov S., Dontsov N., Ekinil G., Oleynikova Ju., Denisenko Ju. 2020 [13], Valeria Provotorina, Lyudmila Kazmina, Antonina Petenko, Galina Ekinil 2020 [14], A. Mai Walder, 2017 [15], J. Chun-Chung Chow, Cheng Ren, Brenda Mathias, Jiaying Liu 2019 [16], Meiju Keinänen, Jani Ursin, Kari Nissinen 2018 [17], Viv Ellis, Ann Childs 2019 [18], Nicole C. Jackson 2019 [19].

Among the main methodological approaches applied to the design of museums, one should single out the systemic, institute and integrated approaches. They provide an opportunity to study the trends and processes taking place in museum construction. In the course of the study, a typological approach is also used, which allows to characterize not only the current trends, problems and contradictions of the transformation of museums, but also to identify possible prospects for this process. The scientific provisions, conclusions and recommendations contained in the article are based on the use of combined methods of historical and logical analysis.

3. Results
The collection of museums existing on a certain territory is called a museum network. The museum network in Russia has been forming over three centuries, and the initial stages of this process were largely spontaneous, although they objectively reflected the economic, scientific and cultural needs of their time. At present, the state museum network of Russia is formed by museums of the system of the Ministry of Culture and departmental museums. About half of the museum network is made up of museums with a complex profile (797 museums, or 49.7%). There are 234 art museums (15%), and this figure is considered rather modest in comparison with other European countries. The rest of the profile groups of museums, including natural science, architecture, and industry, make up on average 1% of the total number of museums (Fig. 1).
In order to better visualize the nature of the development of the museum network in Russia, it is interesting to compare the following figures. Industrialized countries, where 15.6% of the world's population lives, account for 55.5% of museums, i.e. 1 museum for 30 thousand people. In low-income countries, 52.7% of the population lives and 3.1% of museums are located, i.e., on average, 1 museum for 2300 thousand people. And this gap is constantly widening. If in Europe there is 1 museum for 43 thousand people, in Latin America - for 272 thousand people, then in Africa - for 1 320 thousand, and in Asia - for 1 420 thousand.

At present, the museum network in Russia continues to maintain an upward trend - today there are about five thousand museums operating in Russia (i.e., about 1 museum for 300 thousand people).

The Rostov region includes 55 administrative-territorial entities, of which 12 urban districts and 43 municipal districts, as well as 408 administrative-territorial units: 18 urban and 390 rural settlements. The population of the region according to Rosstat data is 4195327 people, of which 68% are urban residents, 32% are rural. The density of the rural population ranges from 8 to over 30 people per square kilometer. Of the 43 municipal districts of the region, 28 of rural population make up 100% of the total population. In other areas, the ratio of urban the population to the rural area ranges from 14% to 65% of the total population of the district, which indicates the unevenness of the territorial distribution of the population.

There are 63 museums on the territory of the Rostov region, including 1 federal one: “The State Museum-Reserve of M.A. Sholokhov”; 15 regional, 27 municipal and 1 memorial one. The annual attendance of museums in the Rostov region is more than 800 thousand people, for comparison, the number of readers in libraries is 689.5 thousand people. The attendance of museums in the Rostov region has grown by 5% over the past 3 years. This became possible due to the expansion of museum areas and an increase in funds, as well as the expansion of cooperation between regional museums and tourist information centers. For 5 years, the main fund of museums has increased by 49 thousand exhibits, and the area of museum spaces has increased by 5 thousand square meters.

The city of Rostov-on-Don and the Rostov region annually attract millions of tourists with their rich history, unique nature, hospitable people, and original Cossack culture. Thus, security issues in museums are of paramount importance.

4. Discussion
A promising direction for improving the structure of the essence of museums is the creation of centralized museum systems on a profile or territorial basis, including (in whole or in part) museums of a certain region.

The centralized museum system usually has the following structure: the head museum; branches; museums as departments (sectors) of the parent museum or branches; independent expositions in
separate buildings, most often in museums of history and culture. In some cases, centralized systems can function without a head museum with the subordination of branches to a single directorate. The place of the museum in the system is determined by the composition of the premises and the nature of the architectural appearance of the building. The activities of the museum association are based on the centralization of management, a unified planning of research, scientific and educational, economic and financial activities, a unified system of accounting, storage, acquisition and use of museum funds.

With centralization, it becomes possible to create joint departments and services focused on solving problems common to all museums in the region. The structure of the association is in this respect rather flexible, easily adaptable to local specifics. The allocation of a special structural unit for the development of architectural and artistic solutions and technical equipment of museum expositions is relevant. In connection with the constant and systematic work in the field of accounting, protection and use of historical and cultural monuments, it is necessary to create departments for scientific propaganda, restoration and museumification of monuments. In a number of cases the functions of the state body for the protection of historical and cultural monuments are assigned to the united museum-reserve. Thus, it is advisable to set up centralized scientific departments, laboratories, workshops, storage facilities in a specially equipped building, taking into account local conditions and specific features of the association.

When organizing centralized museum systems, one of the primary tasks is to develop a master plan. Museums, scientific institutions, the public, monuments protection bodies, creative unions, interested ministries and departments should be involved in its compilation.

The development of exhibition work is characterized by high rates: the number of exhibitions is growing, their topics are becoming diversified, the saturation of exhibitions with genuine museum materials is increasing, the number of items exhibited at exhibitions increases by 4 times.

A necessary prerequisite for the development of exposition and exhibition work in the associations is the dynamic redistribution of funds taking place in them between the head museums and branches and, first of all, the enrichment of new expositions and exhibitions of the branches at the expense of the funds of the head museum: the exhibits of the head museum are in expositions and at exhibitions prepared by the branches, 50 - 80%.

Scientific fund work in centralized systems is characterized by other serious changes, first of all, by a significant increase in the main fund in the head museum and in branches. In this regard, an urgent task is to increase the area of storage facilities.

Creation of united specialized storage facilities for certain types of museum items should be considered promising. At the same time, the most favorable conditions are created for storing museum items in a mode corresponding to one or another material. In buildings for centralized storage of funds, it is recommended to create complex restoration departments, laboratories and workshops serving the branches of the association. The premises must include special exhibition halls for new acquisitions and restored exhibits with a total area of 400 - 600 m².

After centralization, museums have seen a rapid and systematic increase in the total number of visitors. The most intensive growth in attendance is observed in branches. If in general for associations the attendance of museums increases by 38%, then for branches the average growth in attendance is 73%, i.e. almost 2 times more. The outstripping growth in the attendance of branches is a natural and planable result of the development of centralized museum systems.

The outstripping growth in the attendance of branches leads, in turn, to an increase in another important parameter of the united museum system - the share of branches in the system (by 24.2%). The share of branches in the system is defined as the ratio of the annual number of visitors to the branch museums to the annual number of visitors according to the combined system as a whole.

The number of excursions and public events conducted both in the united museum and in the branches is also sharply increasing, their topics are expanding, new forms of mass scientific and educational work are being introduced, and the percentage of excursion services for visitors is increasing.
Success in the development of scientific and educational work is achieved through the introduction of a complex of organizational, methodological and architectural measures. Among them: the creation of centralized departments and sectors of excursion work, scientific propaganda, methods of scientific and educational work of the management of branches, extra-museum work and advertising of the museum. Thanks to this, the contingent of visitors is significantly increased, as well as the opportunity to widely introduce the practice of complex excursions, including visits to museums, branches, historical and cultural monuments, and memorable places.

Complex topics of excursions are becoming more diversified and occupy an increasing proportion in the excursion topics of museums. One of great importance for raising the scientific, ideological and professional level of mass work is a radical restructuring of the system of training and advanced training of personnel. It aims to cover with various forms of training all, without exception, research workers, guides and middle managers. The main museum should become a center for professional training. It is recommended that the joint museum organize schools for staff and non-staff members.

The architectural aspect of this problem is the creation of specially equipped centers, provided with auditoriums and a cinema lecture hall for 200 seats.

The high ideological and professional level of scientific and educational work is combined with editorial and publishing activities.

To do this, it is necessary to provide editorial and publishing and scientific and methodological departments in the premises of the regional center of museums.

The first priority for creating a holistic museum system in the region is the construction of a special building (or adaptation of existing buildings) for the regional center for the management and maintenance of museums.

The recommended composition and area of the premises of the regional center of museums are given in table. 1.

Table 1. Composition and area of the regional center of museums.

| № п.п. | Room groups                                      | Approximate area, m² |
|--------|--------------------------------------------------|----------------------|
| 1      | Directorate and administrative services          | 150                  |
| 2      | Research department                              | 250                  |
| 3      | Scientific and methodological department         | 200                  |
| 4      | Editorial and publishing department              | 120                  |
| 5      | Scientific reference library                      | 200                  |
| 6      | Architectural and art workshops                  | 150                  |
| 7      | Cinema hall                                      | 180                  |
| 8      | Exhibition halls                                 | 400                  |
| 9      | Restoration workshops and laboratories           | 600                  |
| 10     | Cinema and photo laboratory                       | 100                  |
| 11     | Storage by type of materials                     | 2500                 |
| 12     | Production workshops                              | 120                  |
| 13     | Service premises                                 | 150                  |
| 14     | Technical buildings                               | By calculation       |

The town-planning situation, the immediate environment and the actual site of the museum have a significant impact on the architecture of the building. The functional program should be solved in an organic connection with the natural and urban environment. Historically, the only possible location of the museum in the city - exclusively the center - and today retains its relevance.

The uniqueness determines the architectural significance of the museum in the formation of significant urban planning ensembles. With the increase in the number and typological diversity of museums, the emergence of museums associated with a particular place, and the change in their role in social and cultural life, the uniformity of the approach to the selection of a site has also been disrupted. There are numerous examples of the construction of museums outside the city (ethnographic, archaeological and memorial, in a picturesque area that allows you to combine the rest of visitors with
a visit to the museum). Many museums have been opened in the countryside - evidence of the increased cultural level and the blurring of the boundaries between the city and the countryside.

General requirements for the selection of a site for a museum building are shown in Table 2.

Table 2. Requirements for choosing a site for a museum building.

| № п.п. | Site selection requirement | Meaning |
|--------|-----------------------------|---------|
| 1      | Preference for accommodation in the city center | Museums are the leading objects in the formation of the city-wide ensemble. Compliance with this requirement ensures that the museum is equally accessible to visitors from different regions. |
| 2      | The inclusion of the museum in the complex of cultural institutions along with other museums, theater, exhibition hall, library, archive, information center and leisure facilities | The cooperation complements the functional program of the museum and attracts new categories of visitors. |
| 3      | The proximity of the park | for arranging an open exposition, natural protection from noise and pollution and creating recreational areas necessary for the museum; for the construction and future expansion of the museum. |
| 4      | Sufficient area of the territory | |

These requirements do not apply to museums whose location is associated with a specific location: memorial museums; archaeological museums at the site; museums of enterprises, institutions and educational institutions; museums in monuments; open-air museums that require large areas of undeveloped areas, with a landscape characteristic of the region.

When choosing a site for the construction of a museum, the following main factors must be taken into account:

- social goals: preservation of cultural heritage and its promotion; raising the educational and cultural level of the population; scientific research;
- the purpose and specificity of the museum: the place of the museum in the general structure (central, head, branch), type of collection, funds, predominant development of functions (research, scientific and educational, educational and leisure);
- characteristics of the city (settlement): population size, settlement structure, estimated region of coverage by the museum, transport scheme, prospects for the development of the city (settlement) as a whole and the proposed area for the construction of a museum, historical and cultural traditions, development of tourism.

For regions with a high population density and developed intercity public transport, the population of gravitating settlements has a significant impact on attendance;

- natural environment: relief, vegetation, water bodies, geological characteristics, climatic conditions (in terms of the safety of exhibits and the possibility of organizing an open area), the shape and size of the site, restrictions on use, including noise, vibration and pollution, the suitability of the area for leisure activities;
- urban planning situation: the presence of other museums, educational institutions (including schools), scientific institutions (their capacity, type, location and number), places of leisure and recreation; the nearest architectural environment; development trend; an unfavorable
neighborhood for the museum with industrial enterprises, highways, the railway and the airport; the possibility of a phased expansion of the museum building;

- the structure of the population: socio-professional and age composition, educational level, cultural needs, tourists;
- transport accessibility: public transport system in the area of the museum construction, parking lot, pedestrian accessibility to the museum (easily accessible - 15 minutes’ walk or local transport, accessible - 15 - 30 minutes);
- technical and economic considerations: landscaping, carrying out activities accompanying the construction of the museum (roads, communications, etc.);
- special requirements. Local history museums: the originality of the natural landscape and the architectural environment as elements of the exhibition display. Art museums: the possibility of placing works of monumental art in open exhibition areas. Museums in monuments: mandatory protection zones. Technical museums: extended open-air exposition. Museums of enterprises and institutions: the expediency of their placement without restrictions on attendance by the operating hours of enterprises and institutions.

The site of the museum includes the following functional areas: entrance, exhibition, recreational and economic.

The technology of museums requires a high level of technical equipment of buildings, which are equipped with central water heating, cold and hot water supply, sewerage, supply and exhaust ventilation (air conditioning), lighting and low-current devices, including security and fire alarms, lightning protection and electrical equipment.

When starting the research, the developers were guided by the current international and Russian legislation, according to which the museum's safety standards should fully:

- to ensure the protection of the life and health of visitors and museum staff;
- to preserve the property of the museum;
- maintain the safety of museum items from destructive anthropogenic, technogenic and natural factors throughout the entire area of their existence, both within the museum and on the way;
- to exclude the possibility of illegal exclusion of museum items from the special circulation of items of the Museum Fund of the Russian Federation;
- to ensure the safety of the personal property of visitors and museum employees accepted for storage in accordance with the established procedure.

The diversity of tasks facing museum workers and developers, the complexity and diversity of museum collections dictate the need to divide the museum space, as a field of interaction of value streams, into simpler functionally separate modules. The peculiarity of the modular construction of the security system allows the implementation of an integrated security system from simpler systems to more complex ones, from less costly to more costly, from more relevant to less relevant, although regulatory mandatory. When designing museums, it is recommended to consider the following functional modules necessary to maintain a state of security.

Module 1. Monitoring storage conditions for museum items
Module 2. External security of the museum complex
Module 3. The action of museum staff in an emergency
Module 4. Protection of storage facilities from intentional (vandalism) and unintentional damage by visitors and / or employees
Module 5. Current control of museum items at the exposition and annual control of the state of preservation of museum items at the exposition and in the storage
Module 6. Checking the availability of museum items (reconciliation), in the future - an annual inventory of museum funds
Module 7. Controlling the movement of museum items within the museum
Module 8. Controlling the movement of museum items across Russia
Module 9: Controlling the acceptance of cultural property for pre-stock storage (donation, purchase).
Module 10 Controlling the acceptance of cultural property for temporary storage (exhibitions, scientific study, restoration)
Module 11. Prevention of unauthorized interference in the storage and display process by employees

For the implementation of functional security modules, based on the results of the examination of the museum and the coordination of the implementation stages and the financial capabilities of the institution, a certain sequence, the order of implementation of the modules is influenced by the significance and importance of the tasks set for the protection and safety of museum objects and objects, as well as the specifics of the existing conditions of the museum's functioning. Therefore, to calculate the necessary models, a preliminary collection of detailed information about the state of the museum premises and the specifics of museum storage is carried out. Taking into account the need to use accurate calculations and knowledge of complex technical systems in the field of security, it is advisable to entrust the design to a specialized organization. When planning the timing of the implementation of specific modules, modules numbered 2, 3, 11 are put forward as the most important. This is the organization of the outside security of the museum complex, the actions of museum workers in an emergency situation and the prevention of unauthorized interference in the storage and exhibition process by employees. Then, if appropriate resources are available, modules 1, 5, 9, 10 are implemented. The implementation of these modules is aimed primarily at monitoring the state of preservation of museum items and requires certain financial, administrative and human resources. Modules 4, 7 are implemented as additional options, since they are directly related to the accounting and storage of museum items. Lastly, modules 6, 8 are implemented, since they are based on previously created modules. And although the security of the museum institution is provided at the minimum level by the deployed modules 2, 3, and 11, only the implementation of all modules fully covers all aspects of preserving the health and life of employees and visitors and preserving museum values as a particularly valuable state property. The concept is applicable to any museum institution, regardless of ownership. The undoubted advantage of the concept is the ability to implement security by deploying separate security lines (modules) depending on the capabilities of the museum owners and the state of the premises and museum items.

5. Conclusions
The announced comprehensive concept of museum security meets two main requirements that distinguish its innovative nature, and confirms a completely new approach to solving museum security, which is distinguished by its unconditional usefulness. Of no small importance is the fact that the concept is based on the current Russian legislation in the field of museum affairs and is suitable for implementation in any institution in which museum items are stored, regardless of the size, location of the repository and expositions, composition of museum collections, etc. The concept of integrated security provides for its main goal to preserve the life, health of employees and visitors of the museum, with the unconditional preservation of cultural values that are temporarily or permanently stored in the museum.

Taking into account the fact that the field of application of the concept of museum security is the museum space and a multitude of subjects, objects, processes, phenomena and entities, forces and interactions, temporarily or permanently occurring, located, located or acting in this space, it can be argued that the museum acts for the researcher as a system of relations "cultural values - visitors - employees" and a subsystem of more complex relationships "museum - world around".

As a process of interaction the integrated concept of the museum security system consists of two interrelated actions:
• protection of museum items, as a certain set of measures to ensure the physical and legal integrity of items of the Museum Fund of the Russian Federation, in any area of their circulation;

• ensuring the safety of museum items, museum staff and visitors, as the implementation of a certain set of measures aimed at reducing the risk of violation of the physical and legal integrity of cultural property in any area of their circulation.

Taking into account the complex topography of museum institutions, the unevenness of threats to which visitors, personnel and values of various kinds are exposed, one can imagine the concept of museum security as a regulation of the relationship between museum employees and visitors on the territory of the museum institution and the adjacent territory. In accordance with the legislation of the Russian Federation, the provisions of the concept and the rules of conduct in the museum must not violate the rights of visitors and museum staff, as citizens of the Russian Federation and artists. Consequently, with a systematic approach, the integrated concept of museum security implements three interrelated and inseparable functions:

• ensuring the physical safety of cultural values (both items of the museum fund and other cultural values in the museum);

• ensuring the safety of cultural property from external factors;

• ensuring the life, health of employees and visitors of the museum, as well as the safety of personal and state property that entered the museum for protection.

This vision of issues security allows you to take a fresh look at the museum, as an institution and a platform where several flows of movement of entities intersect: cultural values, visitors, museum staff. At the same time, it should be borne in mind that the space of the museum is not homogeneous, since it includes premises that are characterized by different levels of threats and risks to which both museum objects and employees and visitors are exposed.

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