INTERNATIONAL JOURNAL OF CONSERVATION SCIENCE
ISSN: 2067-533X Volume 16, Special Issue, 2025: 537-554 www.ijcs.ro
DOI: 10. 36868/IJCS.2025.si.13

TRANSFORMATION OF EXHIBITION SPACES DURING THE POST-WAR RESTORATION OF UKRAINE'S CULTURAL HERITAGE MONUMENTS

Oleksandr IVASHKO[1*], Marek PABICH[2], Joanna MATUSZEWSKA[2], Mykola ORLENKO[3]

[1] Kyiv National University of Construction and Architecture, 31 Povitrianykh Syl Avenue, Kyiv, 03037, Ukraine
[2] Lodz University of Technology, Institute of Architecture and Urban Planning, 116 Żeromskiego Street, 90-924 Lodz, Poland
[3]Ukrrestavratsiia Corporation, Boryspilska Street, 6, Kyiv, 02099, Ukraine

Abstract

The article draws attention to the transformation of traditional museum and exhibition spaces. The changes that are taking place in them are identified. It is noted that against the backdrop of the war in Ukraine, museums have taken on the unusual functions of events and galleries. It is reported that during the post-war reconstruction of Ukraine, the only way to preserve some of the cultural heritage sites will be to repurpose them for a new function. Two cultural heritage sites are analyzed and compared—the Water Barracks in Bratislava and the Old Arsenal in Kyiv. Their example proves the possibility of creating a new type of public space even based on repurposed military sites.

Keywords: *Transformation; Exhibition space; Cultural heritage site; Ukraine; Post-war reconstruction*

Introduction

The relevance of the topic is due to the realities of the war that Ukraine has found itself in and which is already affecting all spheres of life in Ukrainian society. The war has had a powerful negative impact on cultural heritage sites in various regions of Ukraine and on the construction sector as a whole, where design standards have been radically changed.

Although the war continues and the number of damaged objects is increasing daily, proposals for the post-war restoration of cultural heritage objects are already being actively developed with the participation of such international organizations as UNESCO, ICOMOS and ICCROM.

The article authors conducted a study related to one aspect of cultural heritage, namely the transformation of exhibition and museum spaces during the war and during the post-war reconstruction of architectural monuments in which museums and exhibition halls are located.

Just as the war has brought about fundamental changes in new construction and is likely to change the style of new construction in Ukraine, it has already changed the very sphere of museum work, which was studied using the example of Kyiv museums. These changes were because permanent, unique collections were taken abroad for temporary storage or hidden in museum depositories and their place was taken by temporary exhibitions – most often photo exhibitions, less often exhibitions of contemporary art. So, we have an example of how museums,

* Corresponding author: ghok2233@gmail.com

in the event of a threat to their collections, essentially acquire the functions of galleries and exhibition spaces.

Another change that the authors drew attention to during the study is the possibility of exhibiting works of contemporary art in museums of a traditional style located in historical buildings. Such examples were studied not only in Kyiv but also in Lodz.

The purpose of the study was as follows: to present our own visions of the emergence of new types of exhibition spaces during the post-war restoration of cultural heritage monuments in Ukraine. The need to modernize public spaces is due to the large number of damages and destruction of cultural heritage sites both in large cities of the East and South and in the regions and the need to repurpose many of them for new functions.

Since most of the damage is to local architectural monuments, one can predict problems in finding sources of funding for their reconstruction and further maintenance. Even before the war began, there was already a problem in Ukraine caused by the fact that traditional museums and exhibitions no longer met the needs of society, which was determined by the decrease in the number of visitors and their unprofitability. The war only intensified the need to rethink the role of museum and exhibition spaces in post-war Ukraine.

The authors surveyed military and civilian personnel in Ukraine and refugees from Ukraine who are in Lodz, proving that all groups of people need art as an escape from the present of war as a manifestation of a certain escapism. Thus, in Ukraine, there is a boom in buying tickets for theaters weeks in advance. The need for art is evidenced by the fact that a large number of literary, photographic, musical and artistic works appeared in times of war. Here it is worth drawing parallels with past global wars and noting that war has always been an impetus for tragic creativity and artistic rethinking of life in war.

However, despite the increase in theater attendance, there is no such increase in museums. This indicates that the traditional form of museum or exhibition display is already outdated and an increase in the number of visitors is possible only if approaches to the display are modernized.

Already, the emergence of many museums and exhibitions dedicated to the events of the Russian-Ukrainian war is predicted. In Soviet times, in the cities of Ukraine, particularly in Kyiv, there were many museums of the Great Patriotic War (as the Soviet-German war was called within the framework of World War II). In Kyiv, for example, such a complex is located on the slope of the right bank of the Dnipro. The complex is distinguished by its pomp and the presence of large-scale sculptural compositions and the dominant feature is the huge figure of the Motherland with a shield and sword, the height of which exceeds the height of the Great Bell Tower of the Kyiv-Pechersk Lavra.

Such pomposity was typical of Soviet times when the memorialization of significant events of World War II was a form of monumental propaganda.

In post-war Ukraine, there will be no pomp in the arrangement of such monumental museums, according to the authors, for several reasons:

– first of all, for economic reasons, since the funds will be directed to the treatment of the wounded, prosthetics, reconstruction of housing, infrastructure etc.

– as the experience of World War II has shown, in the first decades after the victory there was no mass appearance of war museums and works about the war since society needs time to move away from it and live a normal life.

Therefore, in our opinion, the most rational thing in the post-war years would be to organize museum and exhibition expositions in existing buildings, including cultural heritage sites that can be repurposed for new functions.

Since the main destruction today is associated with the cities of the East and South, monuments of industrial architecture that are part of the cultural heritage of these regions can be repurposed for such functions.

By the formulated research goal, the following research tasks were defined:

– to identify the problems of post-war reconstruction of cultural heritage sites in Ukraine, especially in the regions;

– to analyze examples of repurposing traditional museums during the war;

– to identify trends in the field of contemporary art and museum studies;

– to analyze the ways of their transformation into modern art spaces using the example of two revitalized sites with the same function but in different countries;

– to investigate the foreign and Ukrainian experience of modern exhibition spaces with the aim of its use in post-war Ukraine, including based on revitalized sites.

Accordingly, sources were processed in the following areas:

– articles devoted to the destruction of the war and the post-war reconstruction of historical cities and individual complexes and objects [1-9];

– problems of preserving the historical environment and the "object-environment" relationship [10-14];

– experience of revitalization with a change of function [15-21];

– restoration methods [22-31];

– features of art in restoration [32-34];

– specifics of modern art forms [35-38];

– principles of exhibition and museum activities during the Russian-Ukrainian war [39-43];

– professional training of restorers and art critics [44-45].

The study of the source base has shown that scientific publications devoted to the damage caused by the Russian-Ukrainian war are just beginning to appear and there is a lack of research in the field of statistical analysis of losses of cultural heritage and analysis of damage from various types of weapons. The study of sources devoted to preserving and restoring the historical environment provides experience in reconstructing Ukraine's destroyed cities. A significant number of sources devoted to the experience of revitalization provide ways to change the function of unprofitable industrial enterprises and other facilities.

A separate group of publications is devoted to restoration methods tested in Ukraine and abroad. However, it is worth noting that the war has radically changed the list of main problems of destruction of cultural heritage; therefore, new restoration methods must be developed.

Familiarization with publications that highlight the specifics of contemporary art provides grounds for the formation of proposals for the modernization of approaches in the organization of exhibition spaces.

Materials and Methods

The purpose of the study determined the choice of general scientific research methods. The method of photo fixation and field surveys of museums in Kyiv, Lodz and other cities became the basis for theoretical conclusions. The method of statistical analysis allowed us to analyze the statistics of the destruction of the cultural heritage of Ukraine by region and by year to determine which objects with which protection status were damaged the most. The method of comparative analysis allowed us to compare the experience of Lodz with the situation in Ukraine and the method of forecasting allowed us to provide probable forecasts regarding the profitability of new-type public spaces in post-war Ukraine.

Results and Discussion

Current trends in the design of exhibition spaces

One of the article's authors, Professor Marek Pabich, has been designing museums for many years and has been researching the principles of organizing modern museum and exhibition spaces. Based on his research and his own design experience, he established the following criteria that modern museum and exhibition spaces must meet to respond in a timely manner to the

demands of a society that needs transformation, change and new experiences. Like other types of human activity, architecture also responds to these challenges by emerging new aesthetics. The factors influencing the change in museum and exhibition spaces have been technical achievements, new materials and technologies and in recent decades, digitalization, computerization, virtual reality and artificial intelligence (after all, a separate section of exhibitions now consists of works of art created by artificial intelligence).

Since the emergence of museum and exhibition spaces, the topic of discussion has been the image that a museum (exhibition) should correspond to and the principles of organizing the exhibition itself, including engineering training. Today, new computer achievements have made it possible to combine ordinary space with virtual reality, to "revive" portraits and to create entire series of paintings in the style of an individual master (for example, Alphonse Mucha or Gustav Klimt). Together, this has led to the modernization of traditional static exhibitions, where elements of virtual reality or installations appear alongside ordinary exhibits and performances are often supplemented with short films.

In addition to museum workers and exhibition organizers, artists are also actively using new technologies in their work and as an example, we can mention the interactive installation Osmose (1995) by Canadian Charlotte Davies. In the same series, we will mention another installation, Violence by Jordan Wolfson, 2017.

Another change in museum and exhibition activities is using digital technologies to ensure that works of art reach the widest possible audience. Creating virtual tours of outstanding museums allows those who, for some reason, cannot visit them in person to join the cultural heritage. As an example, we can mention the "Digital Dunhuang" in China, which, in conditions of limited access for tourists to grottoes with unique frescoes, provides an opportunity to see all the grottoes in comfortable conditions without leaving home.

This becomes especially relevant in the case of people with disabilities and we can be confident that in post-war Ukraine we will observe the development of this specific area of museum work due to the large number of people with disabilities.

Such trends correspond to Daniel Birnbaum's statement that the traditional trend, when in order to view an exhibition one must visit it in a specific location, is being replaced by a new trend, when new technologies allow one to see the exhibition virtually, being anywhere.

Today we are witnessing the emergence of a new type of exhibition space, different from the classical museums and exhibitions, which András Szántó called "machines for presenting classical art forms" at the same time noting that new ways of creating exhibitions emerged from technologies, actually outside the museums themselves [46].

Such modern exhibition spaces are rapidly emerging in countries around the world. In Poland, such an object for multimedia installations is the Melt Museum in Warsaw. An example of the use of virtual activity is also the Museum of Other Realities [47]. The same effects are used in theatrical performances, an example of which is the performance "A Midsummer Night's Dream" in the Old Theatre in Cracow.

On the other hand, the transition of exhibitions only to a virtual format actually equates visiting such virtual museums and exhibitions to a movie. However, viewers need direct acquaintance with the work of art; often at the opening of such exhibitions, the artist or curator himself introduces visitors to the performance itself.

Along with the technologization, so to speak, of museum and exhibition activities, there is also an opposite trend today, based on the artist's contact with nature, which is an allusion to Art Nouveau, which was based on natural forms and elements. As an example of such a trend, we can name the atypical SFER IK Museion (2019) museum on the Yucatan Peninsula, where artists could work directly in contact with nature and exhibit their works there. According to Marek Pabich, this approach of "seeking inspiration in nature" is close to the original Greek word "museion" as "sanctuary of the muses." Returning to SFER IK Museion, one can feel in this

approach of merging architecture and creativity with nature while echoing Wright's theory of "organic architecture" and his "prairie style."

Investigating the change in museum and exhibition trends in recent years, Marek Pabich concluded that the active intervention of digital technologies in traditional museum activities was primarily due to the Covid-19 pandemic, when most activities moved to an online format. People are used to receiving all information via the Internet without leaving home, ordering groceries, studying, working etc.

Conversations with residents of some small towns in Poland have shown that even after the lifting of the quarantine, people continued to buy things online, which led to the closure of many stores. When introducing new technologies into museum activities, this example should be taken into account, since otherwise the traditional museum may eventually be replaced by a virtual one that does not require going to a specific place at a specific time.

Focusing on the problem of the predicted opposition of new forms of expositions to traditional ones, we should also highlight the role of the artist himself, the author of the work of art. Some artists consciously use the latest achievements in their works; for some, their works can be exhibited in the most minimalistic spaces, while for others, they need traditional museum space.

In the following sections, we will analyze how modern exhibitions are organized in museum buildings that are cultural heritage sites. However, since the end of the 20th century, creative experiments by famous architects have intensified in creating new forms of museums, including new principles for organizing exhibition spaces.

An example of such innovation is the concept of a new type of museum – Bilderbude, presented in 1977 by George Baselitz, where the main idea of the internal layout was the lack of hierarchy of halls, where a system of absolutely identical rooms united at the top by a glass roof was used. Unlike SFER IK Museion, this concept assumed complete disregard for the surrounding environment and the only requirements were the simplicity of the forms of the halls and good lighting.

Based on Marek Pabich's research, it was established:

– although the impact of digital technologies will continue to affect museum activities, the museum in its traditional form will continue to exist alongside virtual museums and exhibitions, since visitors need personal contact with a work of art [47];

– the development of virtual exhibitions will continue since they shorten the path of contact between "viewer-work of art" and ensure the availability of viewing the work at any time and in any place.

Modern exhibitions in revitalized architectural monuments

When it comes to newly created museums in specially built modern premises, in most cases these are expositions that are organized according to the principles of innovation and allow for experimentation. At the same time, the task of repurposing objects with a different function, which are also architectural monuments, into a museum function is more difficult.

This problem is predicted to worsen during the post-war reconstruction of Ukraine, since the main problem will arise with architectural monuments of local importance. In the event of the loss of their original function, repurposing such objects may be the only way to preserve them and find funding for their reconstruction. Therefore, we focus on the existing domestic and foreign experience of arranging museums and exhibitions in cultural heritage sites that have been revitalized for a new function. First of all, we will give examples of repurposing former military sites (Fig. 1).

A larger example of reconstruction with the restoration of a military facility is the Slovak National Gallery in Bratislava (Slovenská národná galéria), which is the largest art museum in Slovakia. It was founded in 1949 and is located in the Esterházy Palace and the Water Barracks (Vodné kasárne) (Rázusovo nábrežie 2). From January 2016 to December 2022, the reconstruction of the Water Barracks premises continued with the completion of a new part on the embankment side, the so-called Premostenia (Fig. 2). The investor was the Slovenská národná

galéria; the architects were Ing. arch. Martin Kusý and Ing. arch. Pavol Paňák, Architekti A B.K.P.Š., spol. s r.o.; and the company ELTER Constructions provided the construction.

Fig. 1. Nadszaniec – Bastion IV in Poland. Museum sale. (Photo by O. Ivashko, 2019)

Fig. 2. Modern view of the complex with the courtyard, the historical part and the Premostenia in modern constructions.(Photo by Y. Ivashko, 2024)

Based on the existing scientific sources devoted to this object [48], it is worth comparing the revitalization measures with the revitalization of the Kyiv Arsenal, since in both cases the original function of these two buildings was military, changed to a museum and exhibition. The

brick building of the Kyiv Arsenal dates back to the late 18th–19th centuries; the age of the Water Barracks (Vodné kasárne) in Bratislava is over 250 years (between 1759 and 1763) and during this time they changed their appearance, but it was always a military function. Initially, it was a Baroque building with four wings.

You can compare the restoration work with the adaptation to new functions at the Water Barracks and the Mystetskyi Arsenal in Kyiv.

The historical Water Barracks (Vodné kasárne) is a four-wing complex of three-story buildings without an underground floor, forming a closed courtyard. The initial stage of the barracks' re-profiling into a gallery occurred between 1950 and 1955. The second stage of reconstruction lasted from 1969 to 1977, according to the project of Vladimir Dedechek. At the same time, the object acquired the status of a cultural monument of national importance.

During the reconstruction of the complex in 2001–2022, the fourth wing, which overlooked the embankment, was dismantled under the gallery and replaced with the so-called Premostenia – a modern structure.

The complexity of the reconstruction was that this is an object of national cultural heritage, so the preservation of the authentic appearance of the historical parts was a mandatory condition. At the same time, a modern exhibition space was to appear.

A separate aspect of the survey was the engineering and geological studies of the site and the condition of the foundations; as a result, some parts of the foundations were reinforced with micropiles to restore the statics of the "base-foundation-structure" system.

The survey of the historical parts proved that they have a traditional structural scheme consisting of load-bearing supports and walls; columns with vaulted arches form arcades on all three floors of the volumes. The accent of the historical part is the elliptical risalit (Fig. 3).

Fig. 3. Entrance to the gallery with the outdoor space in front of it (Photo by Y. Ivashko, 2024)

The walls have different thicknesses and, in some cases, are replaced by columns. The study proved the parameters and structures of the original flat ceiling, which has a thickness of 150mm; a feature of the vaults is the use of strong bricks at the edges. The structural scheme is

as follows: the load from the vaults is transferred to the arches of the vaults with a thickness of at least 300 mm. During the reconstruction, soundings were made on the outside of the central wall in the places where the support point of the five vaults on the pillars is located, as well as in the lintels at the junction of the masonry of the walls and flat vaults.

The original masonry was made of solid burnt bricks; however, during the operation of the building, interference with the masonry was recorded, which sometimes reduced the load-bearing properties of the structure (as an example, data are provided on the bricking up of the original openings and the removal of parts of structures and the laying of engineering networks in the arches' heels). The final conclusions were obtained after the removal of the plaster layer. Together, these violated the structural density of the masonry. Therefore, at the stage of surveying the historical part, later changes were determined that were subject to removal.

To assess the load-bearing capacity of the historical brickwork, the quality of the brick and mortar was studied by specialists from the Slovak Technical University, as these parameters became the basis for the working design of the vault reinforcement. The reconstruction and restoration of the Water Barracks complex involved not only the restoration of the historical parts but also the introduction of radical changes to the spaces, which transformed the object into a modern museum and exhibition space (Fig. 4).

Fig. 4. Traditional art exhibitions in the reconstructed historical part. (Photo by Y. Ivashko, 2024)

There were several such cardinal changes and we will talk about them separately.

Transformation of the entrance part according to the requirements for modern large-scale galleries. (Authors: architects Kusý and Paňákom). The main entrance was emphasized and the entrance space in the northern wing was attached to it. The entrance space visually seems spacious, although the barracks wing itself has a small area. The historical facade of the Water Barracks is complemented by an entrance portal with a massive lintel.

When constructing the main entrance, a structure in the form of a load-bearing reinforced concrete frame was used around it, consisting of columns with a cross-section of 800×830mm and beams with a cross-section of 1130×1050mm. Therefore, the new main entrance was constructed from a monolithic concrete structure, which imposed special requirements for manufacturing in the formwork. The columns and beams were not to have cracks, so the mounting

holes in the formwork did not reach the perimeter of the edge of the structure. Cutting of already hardened concrete was used for the edges to be sharp. The front surface of the external formwork was 30-50mm in front of the most protruding part of the curved wall and then the mounting holes on the front surface of the brick were bricked up.

As already noted, in some places, after a preliminary engineering and geological survey, the foundations were reinforced with micropiles. In particular, the foundations under the frame columns were reinforced with three micropiles on each side.

Since at the stage of the main entrance installation, it was necessary to support the opening, a supporting structure was arranged for this purpose from seven steel frames of HEB300 columns and HEB500 beams.

The historical structural scheme was supplemented with new elements: since the project envisaged the use of a reinforced concrete channel in the wall, installation holes were made in the old masonry above the place for the channel. HEB500 beams were concreted into these holes, which were supported by HEB300 steel columns.

While the entrance was being constructed from the outside, temporary reinforced concrete strip foundations were being constructed under the columns. At the same time, the base was injected with a synthetic resin-based substance from the inside.

Another stage of the reconstruction and restoration concerned the reinforcement of the arches and columns of the historical part of the Water Barracks. In particular, there was a discrepancy in the condition of the arches and columns on the first floor from the front facade; they had cracks and damage, so they were reinforced.

The sources record in detail the procedure for strengthening the supports of the front wing [49]:

– a strip foundation was arranged between the foundations of the pillars of the front wing of the building;

– diagonal fastening of the pillars was arranged to relieve them;

– the supports were reinforced with glued reinforcement with subsequent concreting of walls 250 and 350mm thick;

– the pillar was injected with a solution to seal cracks and strengthen weakened fragments of the pillar facing;

– the reinforced concrete wall was bonded with steel plates;

– the temporary substation was dismantled;

– new reinforced concrete arches 250mm thick were manufactured.

The process of reinforcing the supports was gradual. First, the pillar was concreted and then they only started gluing the reinforcement to the neighboring support.

The structural scheme of the ceiling is a reinforced concrete monolithic slab 300mm thick. The ceiling slab simultaneously served as a horizontal support for the upper part of the perimeter wall. In the inner part of the floor slab adjacent to the courtyard, openings measuring 47×5m were arranged to reduce the inter-bearing moment. It was assumed that the bending strength of the slab would be increased using carbon lamellas glued to the inner surface.

To counteract the lateral soil pressure from the courtyard, an underground wall 620mm thick was installed in the side wall of the first floor, which acts as a console and takes on all horizontal loads.

The staircase structure is made of monolithic reinforced concrete 150mm thick. It is supported both at the floor level and by the location of the staircase bracket.

Certain discussions arose during the design process of the new volume of the Premostenia. For example, there was a question about the function of the room below; at first, it was proposed to give it to the storage room and then it was decided to place a library and a reading room there.

During the development of the working documentation, some adjustments were made; in particular, the method of strengthening the ceiling above the first floor, which was initially proposed using carbon lamellas, was changed. The problem arose because the actual condition of

the lower surface of the ceiling did not allow for the arrangement of lamellas, so this method was proposed to be replaced with a simple concreting of the ceiling to a thickness of 80cm.

The sounding ceiling slab above the ground floor proved that the ceiling slab was of insufficient quality from above and this called into question the effectiveness of the proposed concreting. As a result, the original ceiling slab above the ground floor was removed and replaced with a structure with a new seamless reinforced concrete floor. This provided advantages in terms of the duration of the structure, made it possible to hide the wiring inside the slab and provided greater height and, accordingly, greater illumination of the ground floor premises, making the floor less massive and beamless.

So, this indicates the process of adjusting decisions during the reconstruction process.

The second example of a repurposed military building is the Mystetskyi Arsenal in Kyiv. It, like the Slovak National Gallery, is a monument of history and architecture of national importance. The massive brick building of the so-called Old Arsenal is located in the northwestern part of the old citadel of Kyiv at 28–30 Ivana Mazepy Street. Previously, this place was home to the Ascension Monastery, where the mother of Hetman Mazepa was the abbess. The Old Arsenal occupies an area of 28 thousand m^2.

At the end of the 18th century, according to an imperial decree, an arsenal was to be built on the site of the monastery destroyed in 1708. Although it was still believed that the project was developed by engineer general Karl de Chardon, the Russian State Military Historical Archive contains two projects dated May 1783, in which the Arsenal building is presented in two versions: as a two-story and a one-story building.

It is known that the project of Ivan Möller was accepted for implementation and the work, which began in 1784, was supervised by Lieutenant Betychev, from 1797 by Engineer-General von Suchtelin and from April 1799 until the completion of construction in 1801, by Engineer-General Major von Tol. It should be noted that the arsenal was the first Kyiv building made of yellow brick.

According to archival sources, it is known that as of the mid-19th century, the first floor of the Arsenal was occupied by storage facilities for ammunition, weapons, materials, siege artillery supplies, office space and pantries of the Kyiv garrison.

It is known that during the Second World War, the building suffered significant damage. In particular, its southeastern part was destroyed by an explosion.

During Soviet times, the Arsenal was also a regime military facility; later, it housed production, as a result of which changes were made to the structural schemes: internal floors, additional partitions, stairs and annexed volumes were arranged.

Preliminary surveys of the Arsenal during the period of Ukraine's independence allowed us to establish the exact dimensions of the large-scale building and the condition of the structures. It was established that the dimensions in the axes are 165,900×133,450m along the contour with three spans of 8,800m. At the time of the survey, it was a two-story yellow brick building with an incomplete frame. The basement and first-floor rooms were covered with cross vaults, except the area above the first floor with bow brick vaults on load-bearing beams. The condition of the cross vaults was assessed as an emergency, with cracks, places of wetting and loss of brickwork (Fig. 5).

It was found that the columns on which the cross vaults were arranged were also built of yellow Kyiv brick on a lime-sand mortar.

At the time of the surveys, the facades of the Arsenal were painted in ocher, while the keystones of the arches, pilasters, brackets, cornices and rusts were plastered and painted white.

The decoration of the facade planes was achieved thanks to relief brickwork. The uniqueness of the Arsenal also lies in the fact that it is the only fortress in Europe with earthen ramparts that has survived.

The project envisaged the redevelopment of the former military building into a modern public cultural, artistic and museum space, "Art Arsenal" (Fig. 6).

Fig. 5. Emergency condition of the vaults before restoration. From the stocks of the Ukrrestavratsiia corporation

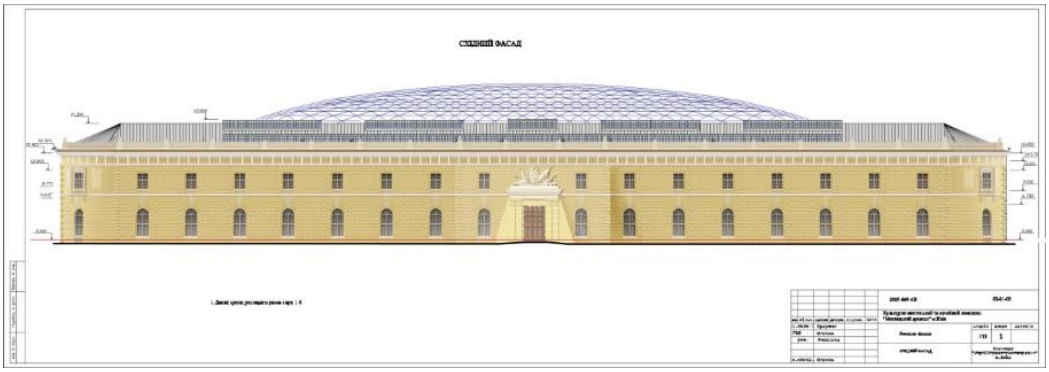

Fig. 6. Reconstruction project with restoration of the Mystetskyi Arsenal.
From the stocks of the Ukrrestavratsiia corporation

It was planned to create two above-ground and three underground museum floors. Functionally, the display was to be located as follows:

– in the underground floors, exhibition halls, a restaurant, a cafe and a shop and galleries are planned for the future;

– on the ground floor with an area of about 12,000m^2 – Shevchenko Hall, Cultural Heritage Hall, Folk and Decorative Art Gallery, Cultural Heritage Exhibition Hall, Café, Conference Hall and three additional exhibition halls, one of which is a hall with organ music;

– on the 1st floor with an area of about 12,000m^2 – six exhibition halls (two with an area of 1,650m^2, three with an area of 600m^2 and one with an area of 500m^2), a Decorative Art Gallery with an area of 3,300m^2, an IMAX-format cinema, a shop, a conference hall, a café and under the glass dome of the ceiling – a library;

– under the moat between the bastions, a two-story underground parking lot for 420 cars was planned;

– the inner courtyard was to be covered with modern metal structures and a transparent coating.

However, the main difficulty in implementing the project was the site's hydrogeological features, with a developed water supply network. Together, this required a solution to strengthen the existing foundations (Fig. 7).

Fig. 7. Strengthening the foundations of the Mystetskyi Arsenal. From the stocks of the Ukrrestavratsiia corporation

Having analyzed all possible options, the specialists of the Ukrrestavratsiia corporation and the UkrNDIproektrestavratsiia Institute chose as the optimal option the strengthening of the historical foundations by partially transferring the load of the walls using transverse thrust beams that pass through the thickness of the wall masonry and are supported by jacked reinforced concrete piles with a diameter of 133mm. Therefore, in this way, the reinforcing structure was a U-shaped frame with rigidly clamped pressing piles with a step of thrust beams in the piers of 3m.

The load for the compression piles was selected separately. A load of 490.3kN was chosen to obtain a calculated bearing capacity of the pile of 411.9kN. This load was supposed to provide the required bearing capacity of the underground part of the Arsenal.

The facade was also damaged, as were auxiliary extensions built during the Soviet era.

Therefore, the project included dismantling the Soviet-era extensions, washing or cleaning the paint layers with a glass-jet machine, cleaning the facades from cement mortar stains, removing the attic pediments in the corner parts, restoring the crowning cornice from limestone blocks, restoring and repairing the openings, grouting and restoring the old masonry, restoring the old vaults, completely replacing the roof and roofing and installing a blind area.

Conclusions

It is worth comparing the features of the repurposing for artistic functions of two former military buildings of approximately the same construction period – the Water Barracks in Bratislava and the Mystetskyi Arsenal in Kyiv. Such a comparison was carried out using a system of indicators.

1. Location.

Both objects are located in the central parts of the cities; the Water Barracks originally faced the Danube embankment and the Arsenal is located on the high right bank of the Dnipro. Both are cultural heritage objects.

2. Outlines in plan.

Both buildings were closed in plan, with an inner courtyard.

3. Original structures

The three-story Water Barracks have a strip foundation system, brick walls, load-bearing supports and walls on which the vaulted arches rest. The original ceiling is 150mm thick; the load is transferred to the arches of the vaults. Before the reconstruction, cracks were observed in the vaults and walls; the reduction in the bearing capacity was also due to the location of engineering networks.

The two-story Old Arsenal had strip foundations, brick walls, a structural scheme with an incomplete frame, brick cross vaults and in some places brick bow vaults on supporting metal beams. The columns on which the vaults rest are made of brick. The original cross vaults were covered with cracks and had traces of waterlogging and loss of masonry fragments.

4. Engineering and geological characteristics of the design areas and foundation systems and structural schemes.

The foundation under the Water Barracks was such that it required the reinforcement of part of the old foundations with micropiles. This is probably because this is a coastal area. The old foundations had a traditional design. While the new entrance was constructed, temporary reinforced concrete strip foundations were installed under the columns. Some areas of the foundation were strengthened by injecting a substance based on synthetic resin.

The original masonry was supplemented with a reinforced concrete channel, as well as beams supported by steel columns; these beams were concreted into the holes above the channel space.

While the entrance was being constructed from the outside, temporary reinforced concrete strip foundations were arranged under the columns. At the same time, the base was injected with a synthetic resin-based substance from the inside.

The supports of the front wing of the Water Barracks were reinforced by installing a strip foundation between the foundations of the pillars; the pillars were unloaded with diagonal fastening and the supports were reinforced with glued reinforcement with subsequent concreting of the walls; cracks and weakened areas were eliminated by injection. A structure in the form of a load-bearing reinforced concrete frame of columns was arranged around the central entrance.

Another stage of the reconstruction and restoration concerned the reinforcement of the arches and pillars of the historical part of the Water Barracks. In particular, there was a discrepancy in the condition of the arches and pillars on the first floor from the front facade; they had cracks and damage, so they were reinforced. New reinforced concrete arches were manufactured.

It is worth comparing the measures that were created to repurpose the Old Arsenal as a contemporary art space, similar in function, construction time, number of floors, materials and layout with an inner courtyard and four wings.

The Mystetskyi Arsenal site also includes loess subsiding soils with groundwater at a depth of 7.1-10.0m with the possibility of their increase. The strip foundations are of small laying made of rubble and brick masonry and the depth of the sole is from 1.8 to 4.4m; the foundations

for the internal columns are also columnar, made of rubble and brick masonry with a depth of the sole from 1.6 to 4.4m. The reason for the subsidence of parts of the walls was the subsidence of the base soil, soil moistening from atmospheric moisture and leakage of water supply networks and various types of foundations with different depths of occurrence.

In the case of both historical buildings, destruction of the masonry and the appearance of cracks were observed. We have already noted that in the Water Barracks, the original masonry was reinforced with a reinforced concrete channel and beams in the openings. In the outer walls of the Arsenal, a system of load transfer from the walls through transverse abutment beams, which pass through the walls and rest on crushed piles, was also arranged. Some other areas were also reinforced in the same way. Only in the Water Barracks are there micropiles and in the Arsenal, jacked piles.

The main reason for the destruction of the masonry of the outer walls and crown and intermediate cornices of the Arsenal was constant waterlogging, which led to destruction and biofouling. Lost and damaged areas of the masonry were replaced with new bricks on a cement-lime mortar. Other parts of the masonry were injected; areas with waterlogging, elevations and biofouling were subjected to antiseptic treatment; and anti-salt treatment was carried out in places of efflorescence.

5. Scale of reconstruction.

If we compare the changes that were made to the original appearance of the Water Barracks and the Old Arsenal, it should be noted that the approach of Bratislava architects, builders and engineers was more modernist, especially considering the complete transformation of the internal space of the historical part and the dismantling of the fourth wing on the embankment for the construction of the Premostenia (Figs. 8 and 9). In contrast, in the case of the Arsenal, the authentic appearance of the object was preserved as much as possible, including the historical vaults inside.

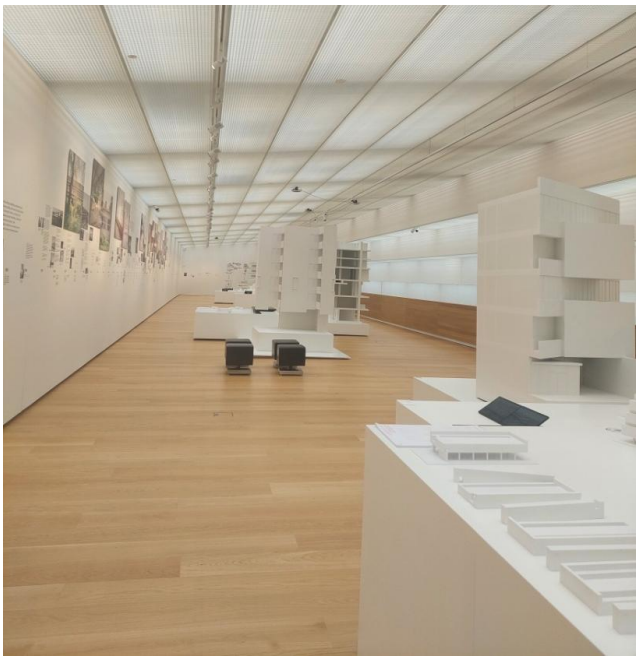

Fig. 8. Exhibition dedicated to the work of architect V. Dedechek (Photo by Y. Ivashko, 2024)

Fig. 9. View from Premostenia to the Danube. (Photo by Y. Ivashko, 2024)

At the same time, both former military facilities are examples of modern art spaces, which turn them into venues for exhibitions in various directions and events. Thus, in the Slovak National Gallery, the expositions are thematically "divided" – traditional paintings, graphics and sculptures are presented in the halls of the historical part of the more conventional layout of the spaces, while the floors of the Premostenia are given over to innovative expositions. One of the floors is given over to the work of the architect Dedeček, where you can see models of his famous objects.

The annual Book Arsenal fair, exhibitions, fashion shows etc. are held in the Mystetskyi Arsenal.

References

[1] D. Chernyshev, Y. Ivashko, A. Mamedov, A. Dmytrenko, O. Ivashko, M. Krupa, D. Kuśnierz–Krupa, J. Kobylarczyk, *Preservation of the Historical Kadetskyi Hai Ecosystem During A Military Threat Using Polish Experience*, **International Journal of Conservation Science**, **15**(Special Issue), 2024, pp. 291-304, DOI: 10.32347/2786-7269.2023.6.139-149.

[2] S. S. Belinskyi, Y. Ivashko, A. Pawlowska, A. Dmytrenko, *Using Poland Experience in Revitalization for the Reconstruction of Ukrainian Cities Destroyed by the War*, **Defining the architectural space. Architecture and the city**, **Vol. 1,** Cracow, 2023, pp. 41-54, DOI: 10.23817/2023.defarch.1-4.

[3] Y. Ivashko, V. Tovbych, A. Hlushchenko, S. Belinskyi, J. Kobylarczyk, D. Kuśnierz- Krupa, A. Dmytrenko, *Preparing for the post-war reconstruction of historical monuments in Ukraine: Considerations in regard of the ongoing Polish post-WWII experience and international law on the protection and conservation of historical monuments*, **Muzeológia a kultúrne dedičstvo**, **10**(1), 2023, pp. 53-71, DOI:10.46284/mkd.2023.11.1.4.

[4] Y. Ivashko, D. Mykhailovskyi, V. Tovbych, J. Kobylarczyk, D. Kuśnierz-Krupa, A. Dmytrenko, Y. Kharaborska, A.V. Sandu, *Problems of Plants Revitalization in the East of Ukraine After the War*, **International Journal of Conservation Science**, **14**(2), 2023, pp. 551-562, DOI:10.36868/IJCS.2023.02.12.

[5] Y. Ivashko, A. Dmytrenko, A. Pawłowska, M. Lisińska-Kuśnierz, M. Krupa, P. Tišliar, A. Hlushchenko, A. Serafin, A. Shpakov, *Destruction of the Architectural Heritage as a Result*

of War: The Experience of Reconstruction (Conservation and Logistical Aspects), **International Journal of Conservation Science**, **15**(Special Issue), 2024, pp. 17-30, DOI:10.36868/ijcs.2024.si.02.

[6] Y. Ivashko, A. Dmytrenko, S. Belinskyi, M. Pabich, D. Kuśnierz–Krupa, J. Kobylarczyk, L. Bednarz, H. Kuzmina, N. Kovtiukh, *The Influence of Colonial Policy on the Destruction of National Cultural Identity and Ways of Overcoming its Consequences*, **International Journal of Conservation Science**, **15**(Special Issue), 2024, pp. 31-42, DOI: 10.36868/IJCS.2024.si.03.

[7] Y. Ivashko, A. Dmytrenko, O. Molodid, O. Ivashko, V. Molochko, S. Belinskyi, P. Bigaj, *The Destruction of the Established Urban Environment of Borodianka and Irpen as a Result of the Russian-Ukrainian War*, **International Journal of Conservation Science**, **15**(2), 2024, pp. 785-800, DOI: 10. 36868/IJCS.2024.02.03.

[8] T. Kozłowski, Y. Ivashko, S. Belinskyi, A. Dmytrenko, O. Ivashko, *Teoretyczne i prawne zasady odbudowy zabytków architektonicznych w Ukrainie, które ucierpały w trakcie agresji rosyjskiej*, **Teka Komisji Urbanistyki i Architektury Oddziału Polskiej Akademii Nauk w Krakowie**, **Volume L**, 2022, pp. 391-408, DOI 10.24425/tkuia.2022.144859.

[9] A. Nadolny, Y. Ivashko, K. Słuchocka, I.G. Sandu, P. Bigaj, *In-fill Development Architecture As Element of Post Second War Reconstruction of City of Poznan. Case Study of Joseph Stübben's Extension Plan of the City from Years 1902–1918*, **International Journal of Conservation Science**, **14**(1), 2023, pp. 57-74, DOI:10.36868/IJCS.2023.01.05.

[10] L. Pujia, *Cultural heritage and territory. Architectural tools for a sustainable conservation of cultural landscape*, **International Journal of Conservation Science**, **7**(1), 2016, pp. 213-218.

[11] P. Spiridon, I. Sandu, *Muselife of the life of public*, **International Journal of Conservation Science**, **7**(1), 2016, pp. 87-92.

[12] P. Spiridon, I. Sandu, L. Stratulat, *The conscious deterioration and degradation of the cultural heritage*, **International Journal of Conservation Science**, **8**(1), 2017, pp. 81-88.

[13] D. Chernyshev, Y. Ivashko, D. Kuśnierz-Krupa, A. Dmytrenko, *Role of Natural Landscape in Perception of Ukrainian Sacral Architecture Monuments*, **Landscape Architecture and Art**, **17**(17), 2020, pp. 13-21, DOI:10.22616/j.landarchart.2020.17.02.

[14] Y. Ivashko, T. Kuzmenko, S. Li, P. Chang, *The influence of the natural environment on the transformation of architectural style*, **Landscape Architecture and Art**, **15**(15), 2020, pp. 101-108, DOI:10.22616/j.landarchart.2019.15.11.

[15] A. Dmytrenko, O. Ivashko, Y. Ivashko, *Development of Creative Economy Objects as a Means of Industrial Territories Revitalization*, **Lecture Notes in Civil Engineering**, **181**, 2022, pp. 487-495, DOI:10.1007/978-3-030-85043-2_46.

[16] M. Dyomin, Y. Ivashko, O. Ivashko, K. Kuśnierz, T. Kuzmenko, *Rozwój trendów i problemów dużych historycznych miast ukraińskich w XX i XXI wieku. Studium przypadku tendencji urbanistycznych i problemów w rewitalizacji dzielnicy przemysłowej*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **65**, 2021, pp. 26-36, DOI: 10.48234/WK65TRENDS.

[17] M. Dyomin, A. Dmytrenko, D. Chernyshev, O. Ivashko, *Big Cities Industrial Territories Revitalization Problems and Ways of Their Solution*, **Proceedings of the 2nd International Conference on Building Innovations**, **ICBI 2019**, **Lecture Notes in Civil Engineering**, **73**, Cham : Springer, 2020, pp. 363-373, DOI:10.1007/978-3-030-42939-3_37.

[18] O. Ivashko, *The issues of conservation and revitalization of the monuments of industrial architecture*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **58**, 2019, pp.113-117, DOI:10.17425/WK58CONSERVATION.

[19] J. Kobylarczyk, D. Kuśnierz-Krupa, Y. Ivashko, L. Savelieva, *Sposoby rewitalizacji historycznych obiektów przemysłowych – doświadczenia międzynarodowe*, **Wiadomości**

Konserwatorskie – Journal of Heritage Conservation, **62**, 2020, pp. 97-103, DOI: 10.48234/WK62INDUSTRIAL.

[20] M. Orlenko, Y. Ivashko, J. Kobylarczyk, D. Kusnierz-Krupa, *Ways of revitalization with the restoration of historical industrial facilities in large cities. The experience of Ukraine and Poland*, **International Journal of Conservation Science**, **11**(2), 2020, pp. 433-450.

[21] K. Stefański, P. Gryglewski, Y. Ivashko, A. Dmytrenko, O. Ivashko, *Revitalization specifics of industrial enterprises made of brick and concrete. Examples of Lodz, Kyiv and Poltava*, **International Journal of Conservation Science**, **11**(3), 2020, pp. 715-730.

[22] S. Baiandin, Y. Ivashko, A. Dmytrenko, I. Bulakh, M. Hryniewicz, *Use of Historical Painting Concepts by Modern Methods in the Restoration of Architectural Monuments*, **International Journal of Conservation Science**, **13**(2), 2022, pp. 381-394.

[23] D. Chernyshev, Y. Ivashko, O. Ivashko, A. Dmytrenko, W. Ciepłucha, *Od rezydencji do kamienicy. Ewolucja i zachowanie historycznej zabudowy miast ukraińskich z końca XIX i początku XX wieku*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **73**, 2023, pp.16-23, DOI: 10.48234/WK73MANSION.

[24] M. Dyomin, Y. Ivashko, *Specyfika stylistyczna zabudowy historycznej okresu secesji (na przykładzie Połtawy)*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **62**, 2020, pp. 79-84, DOI: 10.48234/WK62POLTAVA.

[25] Y. Ivashko, A. Dmytrenko, K. Paprzyca, M. Krupa, T. Kozlowski, *Problems of historical cities heritage preservation: Chernihiv Art Nouveau buildings*, **International Journal of Conservation Science**, **11**(4), 2020, pp. 953-964, DOI:10.36868/IJCS.2024.SI.02.

[26] Y. Ivashko, V. Tovbych, A. Dmytrenko, O. Ushakova, O. Kondratska, P. Bigaj, *Cechy stylistyczne dekoracji secesyjnej na Ukrainie jako podstawa rewaloryzacji*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **68**, 2021, pp. 117-127, DOI: 10.48234/WK68UKRAINE.

[27] Y. Ivashko, U. Shcheviova, L. Zolotar, O. Ivashko, A. Dmytrenko, A. Urakina, M. Początko, S. Rubtsova, *Peculiarities of the "Provincial Secession" Style Development in Ukraine at the Beginning of the 20th Century and Modern Problems of Its Monuments Preservation in War Time*, **International Journal of Conservation Science**, **15**(S. issue), 2024, pp. 321-334, DOI:10.36868/IJCS.2024.si.24.

[28] M. Orlenko, *The system approach as a means of restoration activity effectiveness*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **57**, 2019, pp. 96-105, DOI:10.17425/WK57APPROACH.

[29] M. Orlenko (Chief Editor), **Conservation and Restoration of Architectural Monuments. Guidebook,** Kyiv-Lviv, 1996. (Original language: M. Орленко (гол. ред.), **Консервація і реставрація пам'яток архітектури. Методичний посібник,** Київ- Львів, 1996.)

[30] M. Orlenko, **Problems and Methods of Restoration of Ukrainian Architectural Monuments (11th-beginning 20th century),** Phoenix, Kyiv, 2018. (Original language: M. Орленко, **Проблеми та методи реставрації пам'яток архітектури України (XI-початок XX століття),** Фенікс, Київ, 2018.)

[31] I. Sandu, Gy. Deak, Y. Ding, Y. Ivashko, A.V. Sandu, A. Moncea, I.G. Sandu, *Materials for Finishing of Ancient Monuments and Process of Obtaining and Applying*, **International Journal of Conservation Science**, **12**(4), 2021, pp. 1249-1258.

[32] Y. Ivashko, K. Kuśnierz, M. Krupa, P. Gryglewski, A. Dmytrenko, I. Sandu, *Ways of Performance and Preservation of Monumental Art Works on the Facades of Architectural Monuments of the 19th – Early 20th Century*, **International Journal of Conservation Science**, **12**(4), 2021, pp. 1209-1230.

[33] M. Orlenko, Y. Ivashko, *The concept of Art and works of Art in the theory of Art and in the restoration industry*, **Art Inquiry. Recherches sur les arts**, **XXI**, 2019, pp. 171-190, DOI: 10.26485/AI/2019/21/12.

[34] M. Orlenko, Y. Ivashko, W. Niebrzydowski, H. Trammer, M. Krupa, K. Paprzyca, *Restoration and Preservation Procedure of Architectural Monuments. Railway Stations with Monumental Art of the Socialist Period (on the examples of Ukraine and Poland)*, **International Journal of Conservation Science**, **12**(4), 2021, pp. 1355-1376.

[35] I. Sandu, M. Orlenko, M. Dyomin, O. Ivashko, Y. Ivashko, C.G. Lăzăreanu, K. Paprzyca, I.G. Sandu, P. Sztabinska-Kałowska, *Scientific conservation of the outstanding theatres of the 19th century and their influence on the creation of modern art-space*, **International Journal of Conservation Science**, **12**(2), 2021, pp. 361-390.

[36] M. Dyomin, O. Ivashko, *Street art as a new phenomenon of Art – a means of gentrification of the urban environment*, **Art Inquiry. Recherches sur les arts**, **XXI**, 2019, pp. 129-148, DOI:10.26485/AI/2019/21/9.

[38] P. Gryglewski, Y. Ivashko, D. Chernyshev, P. Chang, A. Dmytrenko, *Art as a message realized through various means of artistic expression*, **Art Inquiry. Recherches sur les arts**, **XXII**, 2020, pp. 57-88, DOI:10.26485/AI/2020/22/4.

[39] S. Belinskyi, Y. Ivashko, I.L. Kravchenko, A. Dmytrenko, I. Dreval, *Analysis of fine-art photography techniques in representing the tragedy of war in Ukraine using Serhii Belinskyi's works*, **Art Inquiry. Recherches sur les arts**, **XXV**, 2023, pp. 345-365, DOI:10.26485/AI/2023/25/22.

[40] J. Iwaszko, A. Pawłowska, O. Iwaszko, **W dobrej I złej doli. Przekształcenia stylistyczne fotografii Sergija Belińskiego,** LTN-Łódz, 2023.

[42] O. Molodid, O. Kovalchuk, Y. Ivashko, D. Kusnierz–Krupa, P. Tisliar, A. Dmytrenko, L. Bednarz, *Research for Banksy Mural 'Judoki' in Borodyanka*, **International Journal of Conservation Science**, **14**(4), 2023, pp.1381-1390, DOI:10.36868/ijcs.2023.04.08.

[43] A. Pawłowska, A. Gralińska-Toborek, P. Gryglewski, O. Sleptsov, O. Ivashko, O. Molodid, M. Poczatko, *Problems of Expositions and Protection of Banksy's Murals in Ukraine*, **International Journal of Conservation Science**, **14**(1), 2023, pp. 99-114, DOI:10.36868/IJCS.2023.01.08.

[44] P. Gryglewski, D. Chernyshev, O. Kashchenko, A. Shilo, Y. Ivashko, A. Dmytrenko, O. Ivashko, *Between Practice and Theory. Comments on the Specificity of Art History and Art Education in Poland and Ukraine*, **Art Inquiry. Recherches sur les arts**, **XXII**, 2021, pp.168-190, DOI:10.26485/AI/2021/23/10.

[45] D. Kuśnierz-Krupa, J. Kobylarczyk, J. Malczewska, Y. Ivashko, M. Lisińska-Kuśnierz, *Analiza jakościowa edukacji architektonicznej w zakresie ochrony miasta zabytkowego*, **Wiadomości Konserwatorskie – Journal of Heritage Conservation**, **65**, 2021, pp. 20-25, DOI: 10.48234/WK65PROTECTION.

[46] A. Szántó, **Imaging the Future Museum. 21 Dialogues with Architects**, Hatje Cantz Verlag, Berlin, 2022.

[47] * * *, https://store.steampowered.com/app/613900/Museum_of_Other_Realities/

[48] B. Skalska-Cimer, A. Kadłuczka, *Virtual Museum. Museum of the Future?* ***Technical Transactions/Czasopismo Techniczne***, **119**, Politechnika Krakowska, Kraków 2022, ss. 1-6.

[49] * * *, https://www.ebeton.cz/clanky/2023_2_52_rekonstrukcia-slovenskej-narodnej-galerie-objekt-vodne-kasarne-a-novy-strop-nad-1-pp-v-objekte-premostenie/

Received: December 22, 2024
Accepted: March 23, 2025