Mykola Orlenko*
orcid.org/0000-0002-4154-2856

The system approach as a means of restoration activity effectiveness

Podejście systemowe jako środek do zwiększenie skuteczności restauracji zabytków

Key words: restoration of architectural monuments, system approach, problems of the emergency condition, restoration technologies, the House with Chimaeras

Słowa kluczowe: restauracja zabytków architektury, podejście systemowe, problemy złego stanu technicznego obiektu zabytkowego, technologie restauracji zabytków, Dom z Chimerami

INTRODUCTION

From the standpoint of the system approach, architectural monuments are perceived as integrity not only as a "thing in itself", but also as an element of integrity of a higher order – the environment, which, as a rule, is determined by the limits of the visual perception zone of a monument. Within these limits, the places most suitable for sightseeing are determined. From these "points" the "views" are opened up, which in their turn become objects of protection not only for the architectural monument, but also for its environment.

Analysis of the visual perception zone of an architecture monument with the use of the modelling and experimental design methods makes it possible to determine the elements of the environment: buildings, green spaces, advertising elements, kiosks, poles of electrical networks, etc., which reduce the level of perception of the monument and are defined as "dominant".

With this approach, the tasks of restoration of architectural monuments are expanding, and not only the monument itself, but also its environment becomes an object of protection and restoration.

An example of such approach is the space between the bell towers of Saint Sophia Cathedral and Saint Michael's Golden-Domed Monastery, where a number of trees, small architectural forms which obstructed the view of the visual axis, were demolished, and comprehensive landscaping was carried out, traffic was sorted, billboards and other things were removed, Fig. 1.

The experience of Samarkand is also well-known, where the areas around the monuments of the world importance – the Gur-e Amir Mausoleum and the restored Bibi-Khanym Mosque, were cleared from buildings that obstructed the visual perception and limited the tourist activity. The expenses incurred by the city in compensation for clearing the territory from the buildings were returned by replenishing the Samarkand budget from international and domestic tourism and from an increase in the number of pilgrims.

This experience of Samarkand is an evidence of expediency to assess the conditions of perception of architectural monuments and, if necessary, to raise the question of the destruction of dissonant objects.

The main feature of the object that determines the characteristics of its urban-planning location, architectural and planning structure, the architectural image is the type of activity for which the building (structure) is designed.

* Doctor of Architecture, Professor of Kyiv National University of Construction and Architecture, President of Ukrrestavratsiia Corporation

* *dr architektury, profesor, Kijowski Uniwersytet Budownictwa i Architektury, prezydent Korporacji Ukrrestavratsiia*

Cytowanie / Citation: Orlenko M. The system approach as a means of restoration activity effectiveness. Wiadomosci Konserwatorskie – Journal of Heritage Conservation 2019;57:96-105

Otrzymano / Received: 08.11.2018 • Zaakceptowano / Accepted: 10.12.2018 **doi:10.17425/WK57APPROACH**

Praca dopuszczona do druku po recenzjach *Article accepted for publishing after reviews*

Fig. 1. The axis between the St. Michael's and St. Sofia bell towers – the historical axis of Kievan Rus. Recreated in 1998–1999

1. THE SPECIFIC FEATURES OF APPLICATION OF THE SYSTEM APPROACH AND STRUCTURAL MODELS IN THE RESTORATION INDUSTRY

Taking into consideration the objectives and tasks of the restoration activity, it is necessary to explore a building as a holistic object regardless of its function, from the perspective of determining the main elements of the restoration intervention, taking into account their importance in the building's activities (supporting structures, enclosing structures, exteriors, interiors, elements of aesthetic and art decoration, etc.)

The structural model of an architectural monument presupposes that it is firstly a piece of architecture, and only then it is a landmark. The status of an architectural monument, as well as other monuments of the immovable historical and cultural heritage, provides for the restoration or conservation of the holistic monument, or its individual component or element, which in essence are subjects of protection; provides for the division of the whole into many parts. So, on the basis of the architectural monument as an architectural-constructive system, in its model it is divided into the following components: subsystems of the first level – footings and foundations, walls, floors, ceilings, crowning, roofs, each of which is in turn divided into the following parts – subsystems of the second level; which is described in detail below:

- the bases – a wall (trunk), a sole;
- walls – basement, gable, cornice, column, window, arch, balcony, bay window, loggia, portico, entrance, vehicular entrance;
- floors – beam, logs, farm, waterproofing, vapour barrier, insulation, floor;
- crown – attic, fronton, drum, dome;
- roofs – spire, roof, bath, chimney, dormer window, attic, parapet.

These second-level subsystems are in turn divided into indivisible elements.

The structural model of the architectural-planning system, depending on the functional purpose of the structure, is divided into main components, which are the basis of the functional-planning organization of the building, which should correspond to the main processes (rituals, rituals) for which the structure is designed.

2. SYSTEMATIZATION OF AUTHENTIC BUILDING MATERIALS AND STRUCTURES OF ARCHITECTURAL MONUMENTS

For restoration activities, reconstruction and recovery of the architectural monuments that have not been preserved, and the society considers it is necessary to restore them, it is important to systematize the information about building materials that form the basis of the building – the main construction and finish materials, materials for exteriors and interiors. In Ukraine traditionally for capital construction, bearing constructions from ancient times to the present different types of wood, natural stone, brick, concrete, reinforced concrete, metal were used, each material has its advantages and disadvantages. Regarding the topic under consideration, it is important to determine the very fact of the application of building materials, as well as the historical period of the prevalent use of these or other building materials, structures and technologies.

The main role in the functioning of an architectural monument in proper condition is played by the statics of the "footing-foundation-building" system. In many cases, the elimination of the emergency state of the object of restoration begins with the strengthening of the footings and foundations. According to the types of structure and building materials foundations are divided into the following: strip foundation, pier and post foundation, slab foundation and pile foundations.

At all periods, except for the beginning of the twentieth century, strip and pier foundations were used. In princely times (10^{th} – 13^{th} centuries) they used foundations of the type "opus mixtum" (mixed construction technique, masonry of boulders and plinthiform bricks on lime-cement mortar), rubble of boulders, rubble concrete foundations, foundations of plinthiform bricks, limestone, sandstone, but in wooden structures (most of them, but they are not preserved) – from oak logs.

During the Middle Ages and the Renaissance (14^{th} – 16^{th} centuries) there were rubble stone foundations of boulders, of limestone, of sandstone and of oak

logs. In the period of the 17th-18th centuries they used foundations of overburned brick, of stone combined with brick, rubble concrete foundations, foundations of limestone, of sandstone, and oak logs. At the end of the 18th – the first half of the 19th century there were foundations of overburned brick, of limestone, rubble concrete (stone, brick) and of oak logs. In the second half of the 19th century, there were foundations of overburned brick, of limestone and rubble concrete (stone, brick). At the beginning of the twentieth century, with the invention of the pile system, besides the strip foundations made of limestone, of overburned bricks and rubble concrete foundationds, the foundations of bored and cast-in-place piles were used. Thus, we can draw the conclusion that the most significant changes in the development of the "footing-foundation" system took place during the time of Kyivan Rus and at the beginning of the twentieth century, while in other periods, those foundation systems that were started in the Old Russian period were practically spread and improved. Yes, this includes the limestone and sandstone foundations, rubble concrete foundations, and footings of wooden and stone buildings, made of oak logs. Some of the types of foundations, like the "opus mixtum" type of foundations, disappeared after the Tatar-Mongol invasion, some – like foundations of overturned bricks – appeared only in the 17th century.

It is very important to have information which concerns binders and mortars that correspond to a particular period and a certain type of masonry. So, for the rubble foundations of the 9th-12th centuries, made of sandstone, granite, quartzite or limestone, lime mortar and lime with powdered brick mortar were used. Clay mortar, lime or lime with powdered brick mortars were used for the rubble foundations with wooden ground sills on the ground, fastened with stakes or crutches (the 9th-12th centuries). Those foundations were made of sandstone, granite, quartzite or limestone. For rubble foundations of sandstone, granite, quartzite of the 10th – 12th centuries with rows of plinthiform bricks (of the "opus mixtum" type), a lime mortar with powdered brick was used. Rubble concrete foundations of the 12th century of boulders with crushed plinthiforms were made with clay mortar (underground part) and lime mortar with powdered brick (superstructure or the whole object). The foundations of the 12th century of plinthiform bricks were kept together with lime mortar or lime mortar with powdered brick.

There were significant changes in the "footing – foundation" system in the fourteenth and sixteenth centuries. In the 16th-17th centuries, masonry of limestone and flat limestone is laid on clay (with powdered bricks) mortar and lime mortar with powdered bricks (superstructure). The sandstone masonry in the 14th – 17th centuries is also made with the use of lime mortar. In the 15th – 16th centuries examples of laying sandstone foundations with the use of clay mortar (underground part) and lime mortar (superstructure) are found in the defensive structures of Podilia.

In the 17th – 18th centuries, laying of red over burned

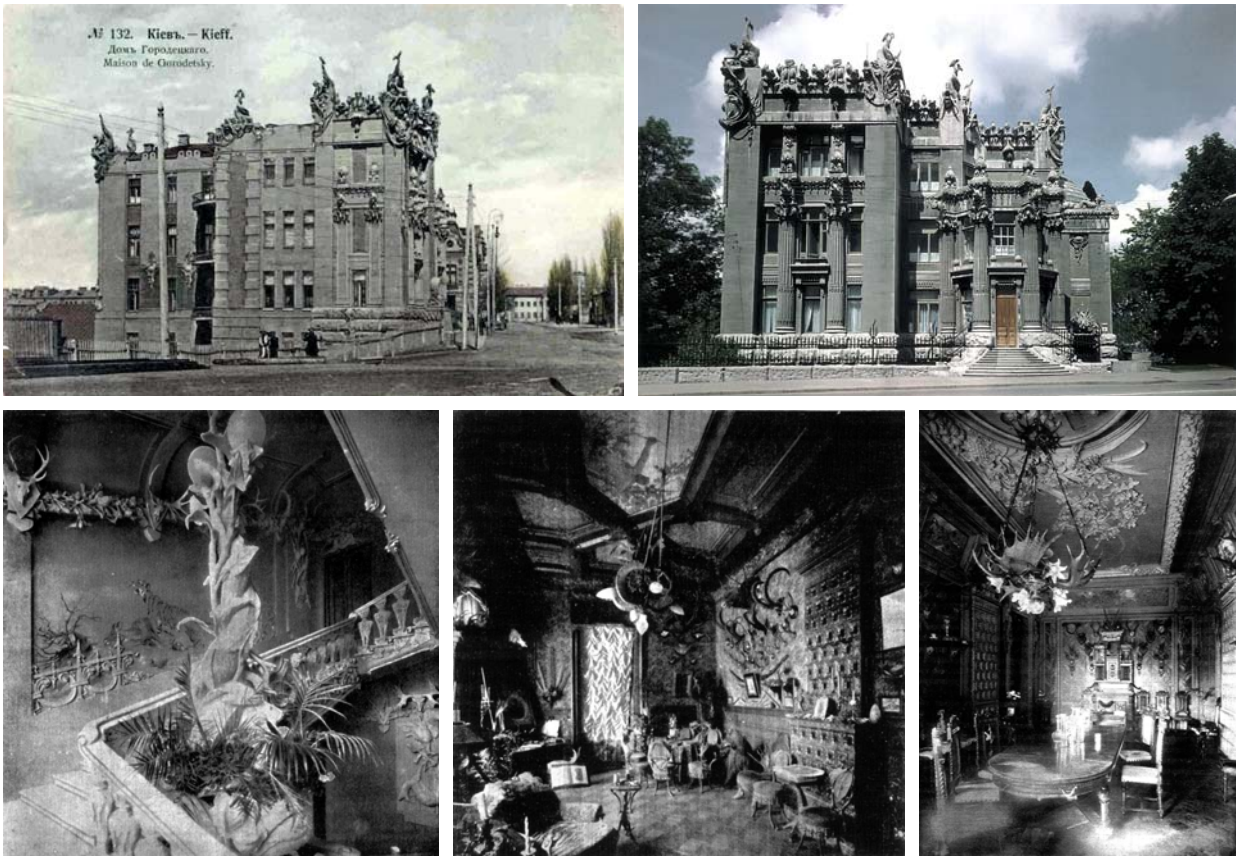

Fig. 2. Archive photos of W. Horodetski's building at Bankova, 10

brick foundations was made with the use of clay, lime, clay-lime mortar. In the 19th century, yellow brick foundations were laid with the use of lime mortar and lime mortar with powdered bricks.

In modern construction practice, the following mortars are used – mixtures of binder, fine aggregate, water, and in some cases with additional special additives: "building" and "organosilicon" to protect the surfaces of facades, the interior and the floor from destruction, weathering, moisture penetration, "masonry" – is used for laying walls of brick, artificial stone, and others [4]. As you can see, modern building mortars are different from those encountered in the restoration and reconstruction of historical objects.

In the practice of restoration work, the selection of mortars is determined by the specific character of the building under restoration, the subject of protection, a special task.

It is also possible to determine in the same way the types of walls that are found in the objects of restoration of various historical periods (wooden, stone and combined). Wooden buildings made of oak, ash, larch, pine, spruce and fir have been known since pre-Christian times; this is the oldest type of structures in our lands. They were made in various ways – "Saddle Notch" "Dovetail notch", "Quarter sawn notch", they used vertical plating.

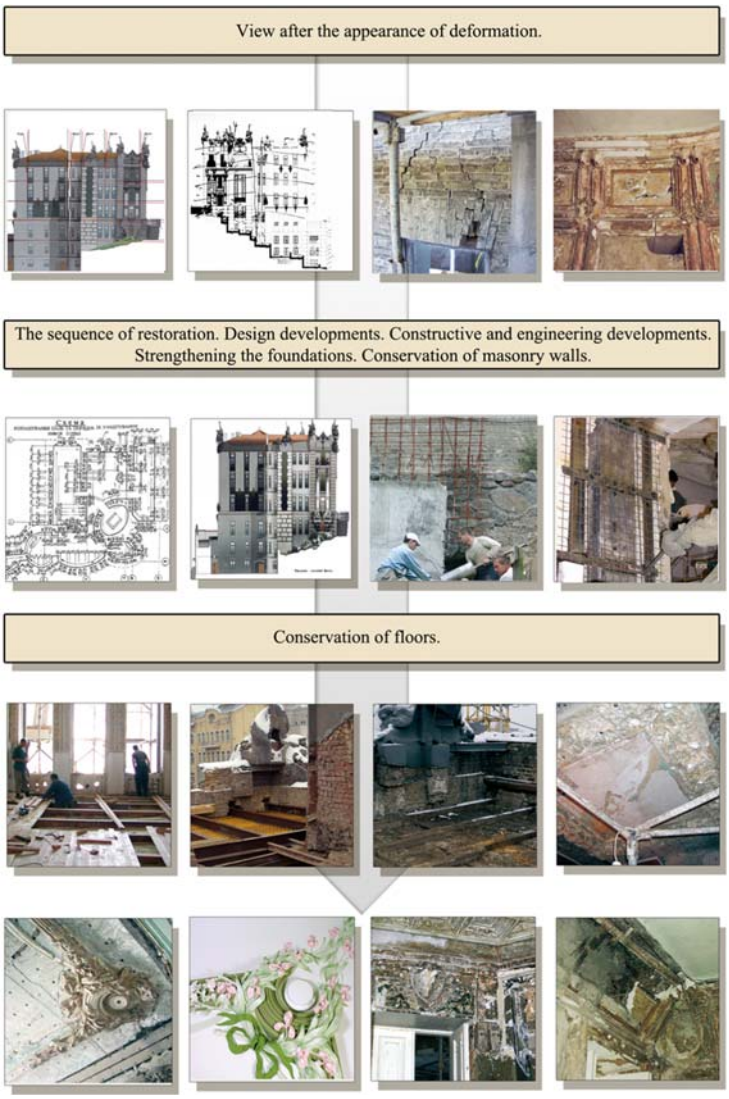

Fig. 3. The problems and restoration methods of the building of architect W. Horodecki at 10 Bankova Street in Kyiv

Stone (masonry) walls were of the type "opus mixtum" and of rubble masonry of sandstone, granite, quartzite and plinthiform bricks with the use of lime mortar with powdered bricks (the 10th – 12th centuries); masonry of layers of plinthiform bricks on lime mortar with powdered bricks (the 10th – 12th centuries); masonry of rubble sandstone on lime mortar (the 11th – 17th centuries); masonry of sedimentary rock stone on lime mortar (limestone, sandstone, tuff) with two layers of the external building envelope with brickwork back filling with the use of lime mortar, lime mortar with charcoal, lime mortar with powdered bricks (11th century); masonry with brickwork layers of red bricks with the use of lime mortar and lime mortar with powdered bricks (the 16th – 18th centuries.); masonry with brickwork layers of yellow brick with the use of lime mortar and lime mortar with powdered bricks (the 19th – 20th centuries.)

There are following combinations of combined walls: rock stone masonry (alabaster, sandstone, wood) with back filling and wooden structures above the level of windows with the use of lime mortar and ganch mortar and lime mortar with powdered bricks (the 12th – 16th centuries); half-timbered walls with a combination of brick and wood on lime mortar; lime mortar with powdered bricks and mixture of lime and ash (the 17th-18th centuries); half brick work masonry of brick and wood with the use of lime mortar and lime mortar with powdered bricks (the 19th-20th centuries.)

According to the experience of the Ukrainian school of restoration, on before restoration the following scientific and restoration researches are carried out: archaeological, historical and archival, bibliographical, architectural, hydro-geological, engineering, scientific technological, chemical and biological. It is determined the condition of the roof with the degree of damage to materials and components, the condition of the roof structures with the specification of deformations and the identification of the causes of their occurrence. Further, an survey of the state of exterior surfaces is carried out, which begins with an inspection of the state of the masonry and the identification of destructive factors and a survey of the state of the basement and foundations; After that, the surveying of the state of the structures is carried out: it is determined the state of the masonry of the walls; the destructive elements and the presence of deformations are revealed; the state of the finishing

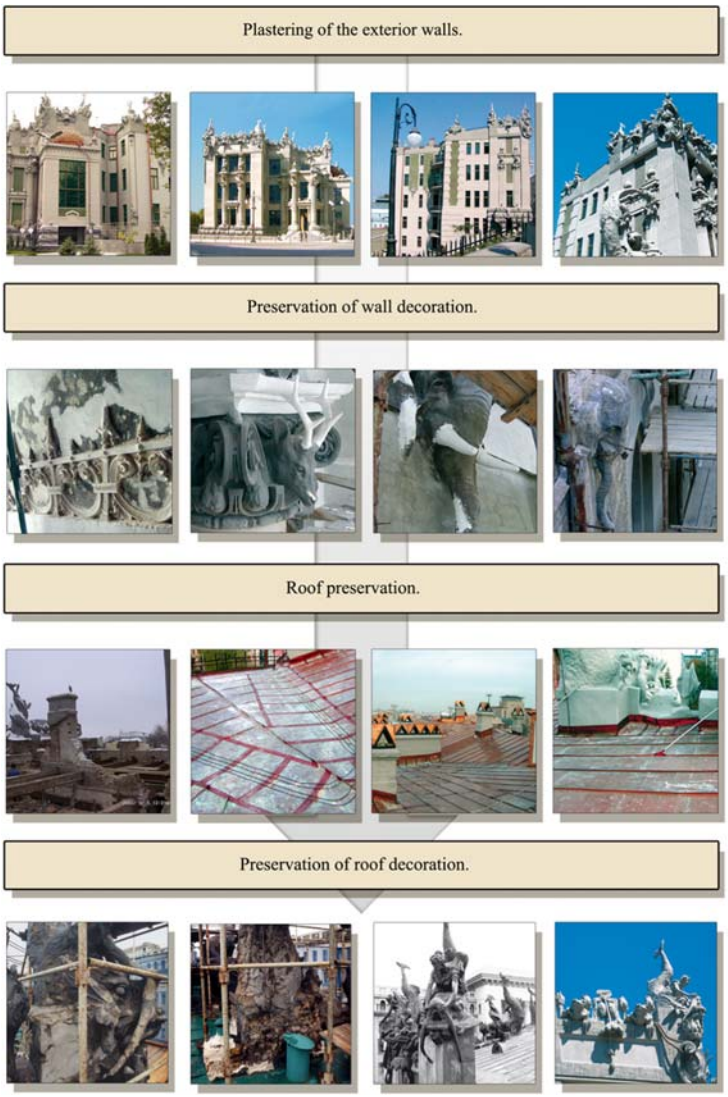

Fig. 4. The problems and restoration methods of the building of architect W. Horodecki at 10 Bankova Street in Kyiv

layers are determined, the basement and the foundation of the architectural monument are examined. When surveying the state of the building structures, samples of original building materials are taken. At the same stage, on the basis of a detailed study of materials, their chemical composition and structures and a comparison of these data with information about the features, the dates of construction and existence at each historical period of construction of the architectural monument are specified. The nature and causes of destruction are identified.

After surveying the state of the exterior, a technical survey of the state of the interiors is carried out, which starts from the basement and to the roof structures. It is envisaged to determine the state of the ornamental finishing of the interior and decorative elements and components, with the determination of their state and the presence of damage.

On the basis of the data obtained, it was developed the methods for strengthening of the structures of the architectural monument and it was made the selection of the authentic materials for the repair and restoration works at the architectural monument. Based on the detailed survey of the state of materials and structures of the architectural monument, the technology of repair and restoration (conservation) works is being developed by comparing various types of restoration technologies in order to determine the optimal solution.

3. RESTORATION OF THE "HOUSE WITH CHIMAERAS" AT 10, BANKOVA STREET

The system approach and the importance of the process of organizing restoration work should be illustrated with a typical example – the building of architect Władysław Horodecki at 10 Bankova Street in Kyiv.

Restoration of the House with Chimaeras at 10 Bankova Street is an example of the restoration of a unique building of the Art Nouveau origin epoch in Ukraine, where the latest design and engineering solutions of the time were applied: the use of strip and pile foundations for construction in complex relief and subsidental soils, concrete and cement for decorative finishing. Construction continued during the years 1901–1903. The building had a different number of floors – it was four-storeyed from the side of Bankova street and six-storeyed from the courtyard. The building was lushly decorated with cement decor on the facades and a picturesque and cement decor in the interiors. The theme of the decor was the animal underwater and terrestrial worlds, hunting attributes.

The entrance hall, round in plan, is covered with a vaulted octagonal ceiling construction, and an ocean octopus spreads its arms along the ribs. In the centre of the front staircase there is a sculptural composition of two huge fishes, which are intertwined with tails and entwined with water lilies; the flowers with built-in white frosted lamps – balls completed the water lilies. The fencing of the main staircase was also unusual, where the balusters were made in the form of bird legs with claws, and in the middle of the fence there were sculptures of two cupids with a cartouche.

According to Władysław Horodecki, the facade is decorated with images of living exotic animals, the interior – with hunting trophies. Even the chandeliers and furniture in the owner's apartment were made of deer and elk horns, and there were also hides of bagged animals, Fig. 2.

The building was partially built on strip foundations (from the side of Bankova street), and partly on bored piles from the side of the slope (first used by an engineer A.E. Strauss). The construction of two foundation

systems without the use of contraction joints led to the uneven building subsidence and then to the appearance of cracks, and this process began to manifest itself soon after construction had been completed. Due to prolonged strong soil moistening of the footing under foundations, the foundations and walls subsided unevenly. Despite repeated attempts to eliminate cracks, they did not produce any noticeable results. Previous restorative measures of injection of cement and polymer cement mortars into cracks had proved ineffective.

The reason of cracks was not eliminated, and because of the presence of a number of internal channels in the walls of the building, the injection mortar got into the channels, and its appearance in various places could not be foreseen. The inefficiency of previous restoration measures was confirmed by the fact that as of 2002, the building split into two parts and the walls were inclined from the vertical by 38 cm., Fig. 3.

In the House with Chimaeras, the restoration activities of 2001–2003 began with scientific and restoration researches, as well as the development of methods for strengthening building structures, first of all, strengthening the footing and foundations.

The measures envisaged to install around the perimeter of the "House with Chimeras" 177 needle piles and jacked piles with a diameter of 132 mm to a depth of 8 to 21 m, with the load on each of them being 40 tons. To eliminate the split of the building into two parts, both parts were "sewed" with horizontal piles – steel reinforcing bars, the walls were reinforced with reinforcing bars according to the method of "raticolo cementato" (Italian "Cemented lattice") [6–7], the cracks were injected. These works were carried out together with constriction and strengthening with the use of steel channels of deformed and rotten beams (applying the prosthetic method) of internal ceilings, tightening and strengthening of emergency stucco molding with copper pins (which lost about 60% of the mass in the interior), Fig. 3. Walls of the "House with Chimaeras" were made of yellow Kyiv brick with the use of various masonry mortars – cement mortar in the masonry of the basement and lime mortar in the masonry of all other floors.

The problems were as follows: the front masonry had some mechanical fractures, all the surfaces of the northern facade and the basement were damaged by wood-destroying insects because of prolonged wetting of the walls and disruption of the paint layer. The survey recorded the presence of numerous through vertical and oblique cracks of sedimentary character with a tendency to further open. The greatest number of cracks was recorded on the northern and southern facades, on these facades there was a violation of the masonry with the fallout of bricks. The maximum width of crack opening here was 1–1.5 cm, at the main entrance on the northern facade – up to 4 cm. In some cases, the presence of cracks was hidden under a layer of plaster.

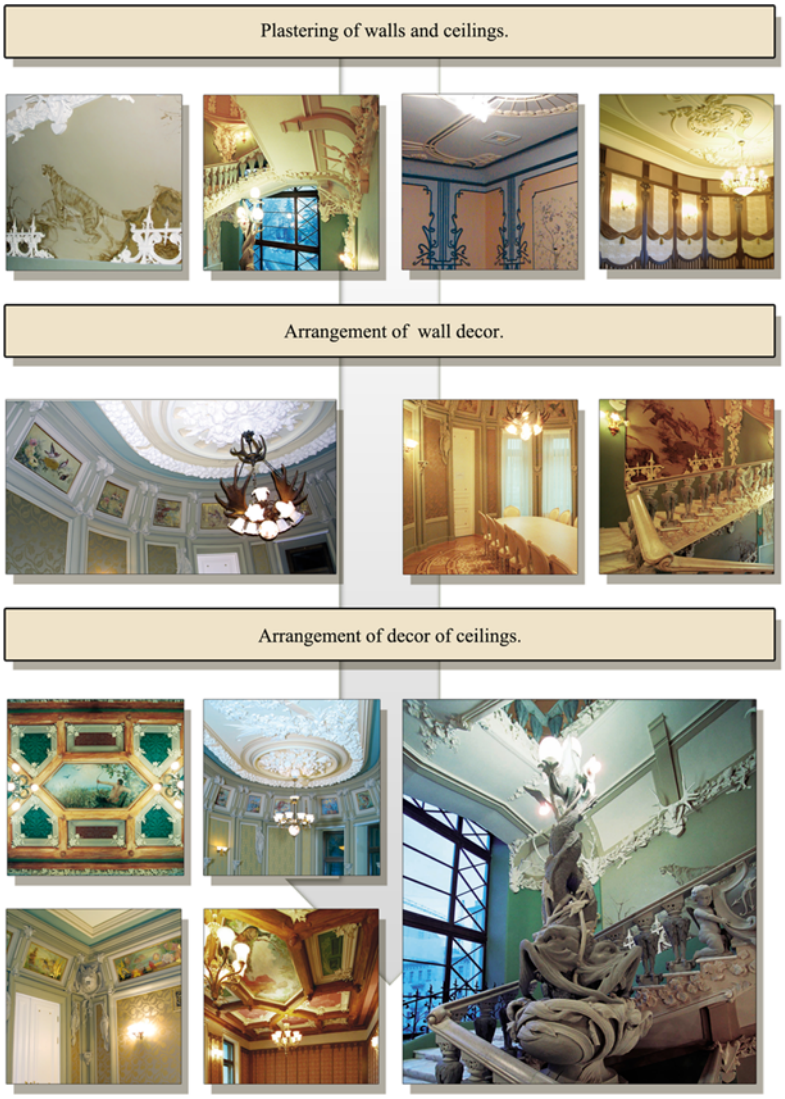

Fig. 5. Restoration methods of the building of architect W. Horodecki at 10 Bankova Street in Kyiv

The balconies of the southern facade were in unsatisfactory condition due to wet monolithic reinforced concrete balcony slabs, as a result of which there was destruction of concrete and corrosion of the reinforcement; the metal fence with damaged metal and loss of the paint layer were also in poor condition.

In 2002, a comprehensive survey of the roof, floors and roof structures of the House with Chimaeras was conducted, during which the accident rate of the wooden roof structures and garret floor was identified due to the bio damage of the beams in places of wetting. The roof of galvanized metal was also in the emergency condition.

For the period of the survey in 2000, the surfaces and decor of the House with Chimeras were plastered and painted in the dark grey colour with cement milk with pigment (soot). The base of the main facade and side facades was decorated with black metal-reinforced rustication, made of cement mortar with imitation under the boulders of natural chipped stone.

For the period of the survey, the rustications were in an unsatisfactory condition, were covered with through cracks, with broken away pieces of mortar. The destruction of rusticated blocks was due to the wetting of the brickwork and the ingress of atmospheric moisture into the thickness of rusting through surface cracks and pores and metal corrosion inside the rusticated blocks. Periodically, the surfaces of the rustication were covered with bio destroyers. For the period of the survey in 2002, the brickwork of the walls of the main facade had a plaster layer of cement-sand mortar and stucco decorations (sculptures, sculptural groups, stucco elements) made of the same mortar. Cement decoration was destructed, cracked and was partially lost. For example, the sculptural decoration of the main entrance suffered from cracks as its reinforcement with black metal led to its corrosion, as well as it was damaged by erosion and bio destroyers. The decor of the main facade was also presented in the form of decorative mirrors, lined with dark gray-green (moss) glazed ceramic tiles. The ceramic decoration was in somewhat better condition than the stucco decoration, however, it also showed chipped glaze and ceramics, pollution and salt efflorescence.

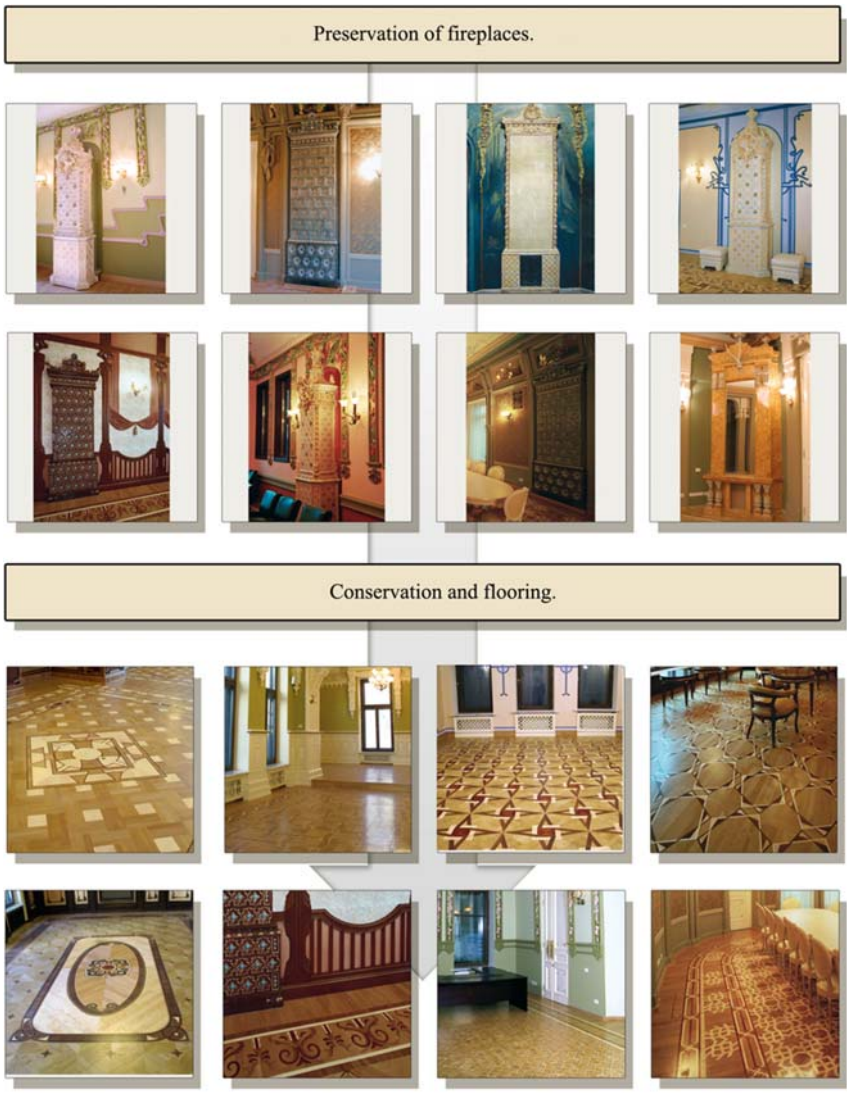

Fig. 6. Restoration methods of the building of architect W. Horodecki at 10 Bankova Street in Kyiv

Assessment of the state of the facade of the building in 2002 proved that the main facade was not originally painted, and its colour was determined by the colour of the plaster and facade decor. In the original version, the colour of the outer layer of the basement and fences, the columns and the front door decor was grey; the colour of the stucco of the facade was dark grey; the colour of the ceramic tiles of the facade was grey-green (mossy). The southern, eastern and western facades were originally painted with lime paint in a light grey colour.

"House with Chimaeras" facades combined different textured finishes: small patterning of the stucco layer with bouchard (bush hammered finish), smooth surface finished in stucco, treatment of the cement-sand mortar layer with scraper, cutting of the stucco layer into thin rusticated blocks. Various types of masonry mortars were also used: the cement mortar in the masonry of the semi – basement, the cement-lime-sand mortar on the ground and first floors, the lime-sand mortar on all floors from the second to the fifth. The western courtyard, southern and northern facades had brick non-plastered surfaces, which over time underwent pollution.

On the facades, erosion of the masonry and destruction of the masonry mortar was observed, as well as loss of the decorative overlaid dark grey cement roller for jointing in the masonry on almost all the facades. The stucco layer of the under eaves surfaces with hanging stucco decoration cracked and formed conglomerates, and the salt efflorescence from the wet brickwork were observed in the cracks.

The luxurious facade decor was in a state of emergency, primarily because the metal reinforcement inside the sculptures was rusted, the sculptural and stucco decoration of the walls was mainly in the cracks and in an unsatisfactory condition, including falling off of separate fragments, Fig 3–4. Previous methods of

eliminating the emergency state of facade sculptures by injecting cracks with adhesives, resins, did not bring a noticeable effect. Later, restoration of the sculptural decoration was carried out in order to remove emergency parts, replacing rusted fittings with stainless steel fittings and preserving fittings that could not be removed. At the same time, the moulded decor was fixed with the brass pins with the gaskets, dowels and pins, the losses were completed and the cracks were filled with cement-sand mortar. However, the reasons of the emergency of the sculptural decoration due to damping and then corrosion of the reinforcement were not eliminated, especially since the sculptures did not have a high-quality protective paint layer. In 1992, the following decor survey was carried out and even then its condition was assessed as emergency. During the restoration works of 1992–1993, the cavities of the façade sculptures were filled with a foamed polyisocyanate solution, along with this, the cracks in the cement of the sculptures were treated and filled with a synthetic injection solution "Monolith"; the front surface of the facade sculptures was further impregnated with the polyisocyanate reinforcing solution and coated with the protective paint layer based on a mixture of polybutyl methacrylate and organo-siloxane polymer with the addition of a pigment to achieve a grey colour. The open metal fittings of the retaining parts which were not embedded in the cement layer, were covered with paint of the same composition. The sculptural elements of the facade were fastened to each other and to the wall – with the use of steel anchors.

The next surveying of the state of sculptures in 2002 recorded that the closing techniques applied during the conservation works of 1992 were effective, cracks were not unfolded, but a paint layer was at the stage of destruction. The appearance of additional cracks was observed in the layer of cement mortar. During the surveying of the building in 2002, it was proved necessary to carry out a repeated, urgent, comprehensive restoration of the monument and all its parts outside and in the interior.

Particular elements of the sculptures of the "House with Chimaeras" (namely, the tails of the fish at the crowning) kept only on the exposed corroded metal reinforcement. The appearance of the salt efflorescence along the cracks on the surface of the plaster proved that the inner cavities of the sculptures were getting wet and the brick bases under sculptures became soaked and were subjected to destruction. The emergency condition of the stucco decoration hanging from the cornice was due to the fact that in 1992 it was not performed the complete conservation of the building. In 2001–2003, the sculptures on the roof of the "House with Chimaeras" were preserved; the reinforcements damaged by corrosion were removed and replaced with stainless steel fittings. According to W. Horodecki the interiors of the ceremonial premises of the apartment of the owner, the staircase with stucco decoration and

Fig. 7. W. Horodecki House at 10 Bankova St., after the completion of the restoration work

wall paintings, sculpture of the stairs and the entrance hall with the octopus were restored.

CONCLUSIONS

The specific features of the "House with Chimaeras" were as follows: a complex engineering and constructive solution (complex relief, subsiding soils, simultaneous use of strip and pile foundations, changing of the hydrogeological conditions of the soils of the base), different number of floors, original decorative decoration of concrete and cement and facades and picturesque and cement decor in the interiors.

Due to subsidence and cracks in load-bearing structures and decorative elements, the building split into two parts and the walls inclined 38 cm from the vertical, the front masonry had few mechanical chips, there was a violation of masonry with bricks falling out, wetting of the brickwork and penetration of atmospheric moisture into the thickness of rustication through surface cracks and pores and metal corrosion inside the rusticated blocks. All surfaces of the northern façade and the basement were damaged by bio-destroyers through long-term wetting of the walls and disruption of the paint layer. The balconies of the southern facade were also in poor condition, as a result of which concrete destruction and reinforcement corrosion were observed, the fence with damaged metal and loss of paint layer, the wooden structures of the roof and garret floor due to damaging of beams by bio destroyers in wet areas were also in poor condition, the galvanized roof was in the emergency state. Cement decoration was destructed due to corrosion of the reinforcement and covered with cracks and was partially lost, suffered from erosion and bio destroyers, and the ceramic decor was distinguished by chipped glaze and ceramics, pollution and salt efflorescence. In addition, the colour solution of the facades and interiors was changed several times.

The reasons of an emergency condition: the construction of two types of foundation systems without the use of the contraction joints, which resulted in uneven subsidence of the building and the appearance of cracks, changes in the hydro-geological conditions of the base soils, prolonged strong moistening of the base soils under the foundations due to the flow of external engineering networks on Bankova street near the building.

The primary measures were as follows: strengthening the footings and foundations with needle piles and jacked piles with a diameter of 132 mm to the depth of 8 to 21 m; to eliminate the split of the building into two parts, both parts were "sewed" with horizontal piles – steel reinforcing bars in the brickwork, the walls were reinforced with reinforcing bars with the use of the method of "raticolo cementato" (Italian "Cemented lattice"), the cracks were injected. These works were carried out together with constriction and strengthening with the use of steel channels of deformed and rotten beams (applying the prosthetic method) of internal ceilings, tightening and strengthening of emergency stucco moulding with copper pins (which lost about 60% of the mass in the interior). The sculptures on the roof of the "House with Chimaeras" were preserved; the corrosion-damaged reinforcement was removed and replaced with the stainless steel fittings, the interiors were restored according to archival photographs and survey materials, Fig. 5–7.

A view at the building as an object of restoration allows us to distinguish at least two aspects: the first one considers the building of an architectural monument as an architectural and constructive system consisting of supporting and enclosing structures (roof, crowning, wall, foundation); the second one considers the building as an aggregate surfaces of the exterior (roof, crowning, wall) and interior (ceiling, walls, floor), which, in addition to purely utilitarian functions, are the carriers of semantic information, which is of particular importance for the specialists in architecture, art and artists – painters, sculptors and architects-restorers.

The specificity of the restoration industry and its difference from traditional construction also lies in the fact that even when most of the constructions and authentic materials are in the emergency condition, restorers try to preserve them as much as possible by selecting reinforcement methods and restoration technologies for each specific task; therefore, these activities are more expensive, taking into consideration their uniqueness compared to traditional construction.

In some cases, in order to comply with the authentic appearance of a restored or recreated landmark, restorers have to revive lost ancient techniques on domestic equipment (for example, the smalt for mosaics of the St. Michael's Golden-Domed Monastery was reproduced on domestic equipment, and the restorers used a unique mosaic technique for creating mosaics and restored the art of making multi-tiered carved baroque iconostasis), and there are a lot of such examples.

BIBLIOGRAFIA / REFERENCES

[1] International Charter for the Conservation and Restoration of Historic Monuments and Sites. Methods and practice of preserving monuments of architecture. Moscow, 1974, 123–127.

[2] Methods of restoration of architectural monuments [ed. IS V. Mikhailovsky]. Moscow, 1977.

[3] National (state) statistical classifiers (classifications). State Statistics Service of Ukraine. Kiev,

1998. 2003. Access mode: http // ukrstat.org / uk / work / klass200 n.htm.
[4] Orlenko M.I. Background of the restoration, its tasks and status at different periods / Urban planning and territorial planning: Nauch.-tekhn. compilation / answer. ed. N.N. Sturgeon – M., KNUBA, 2016. – Vol. 62, pos. 1. – C.419–434.
[5] Domin, M.M. & Orlenko, M.I.(2017). The systematic approach to monuments and restoration activities. Urban planning and territorial planning: Scientific and technical collection. Osietrin M.M. (Ed.) – Kyiv, KNUCA. – Issue 65. – pp.21–32.
[6] Lissi F. Root pattern piles under pinning. Proc. Symposium on bearing capacity of piles, Roorkee, 1964.
[7] Lissi F. The static restoration of monuments. Sager Publishers, Geneva, 1982.
[8] Polak T. Koszty w budownictwie konserwatorskim: tablice do obliczania wstępnego kosztu robót budowlano-konserwatorskich w zabytkowych obiektach architektury. Warszawa, 1971.
[9] Polak T. Struktura organizacyjna przedsiębiorstwa państwowego „Pracownie Konserwacji Zabytków". Warszawa, 1971.112 s.
[10] Polak T., Łotysz A. Zamki na kresach: Białoruś, Litwa, Ukraina, Pracownia Badań i Konserwacji Obiektów Zabytkowych, Wydawnictwo „Pagina",: Pracownia Badań i Konserwacji Obeektısh rytkowytwo Pärina, Pagtttttttz „" Pärina Kon:ys
[11] Polak T. Costs in conservator construction: tables for calculating the initial cost of construction and conservation works in historic architectural objects. Warsaw, 1971.
[12] Polak T. Organizational structure of the state-owned enterprise "Pracownia Konserwacji Zabytków". Warsaw, 1971.
[13] Polak T., Łotysz A. Castles on the borderland: Belarus, Lithuania, Ukraine, Laboratory of Research and Conservation of Historic Objects, Publishing House "Pagina",: Laboratory of Research and Conservation of Historic Objects, Warsaw 1997.

Abstract

The article analyses the possibility of applying a systematic approach for greater efficiency of the restoration industry.

The analysis of restoration problems is also carried out according to the method of system-structural analysis and in accordance with the developed information models.

The external surfaces of the restoration object are analysed in accordance with the structural-logical model, which includes the foundation, wall, crowning and roof.

The components of the process differ in cases of a completely destroyed and reproducible object, a significantly destroyed object or a partially destroyed object.

Methods of the structures strengthening, restoration materials and technologies are selected in such a way as not to disturb the original construction of the architectural monument, if it has been preserved in whole or in part (as it was done in St. Vladimir's Cathedral in Chersoneses); or include new materials and structures in collaboration with the old masonry, if the monument has undergone severe destruction (as it was done in the Assumption Cathedral with John theological chapel) or only the foundations with several rows of masonry walls were left (as in St. Michael's Golden-Domed Monastery, Kyiv).

By the example of the architectural monument – "House with Chimaeras" at 10 Bankova Street, we analysed the specific issues of restoration of objects and the sequence of restoration works with the elimination of the emergency state of the architectural monument.

Streszczenie

W artykule przeanalziowano możliwość zastosowania podejscia systemowego dla uzykania większej skuteczności w procesie konserwacji zabytków.

Analiza problemów konserwatorskich jest prowadzona przy pomocy metod analizy systemowo-strukturalnej, z wykorzystaniem rozwiniętego systemu informacji o obiekcie.

Zewnętrzne powierzchnie rewaloryzowanego obiektu są poddane analizie według strukturalno-logicznego modelu, który obejmuje informacje dotyczące fundametów, ścian, zwieńczenia oraz dachu.

Składowe procesu różnią się w zależności od tego czy obiekt jest zniszczony w całości, ale nadaje się do rekonstrukcji, zniszczony w znacnzym stopniu lub tylko częściowo.

Metody wzmocnienia konstrukcji oraz materiały i technologie konserwatorskie są wybierane w taki sposób, aby nie zaburzyć oryginalności obiektu, jeżeli jest on zachowany w całości lub w części (tak jak ma to miejsce w przypadku katedry św. Włodzimierza w Chersonesie). Nowe materiały oraz element konstrukcyjne wprowadza się do istniejacej konstrukcji, jeżeli jeśli zabytek uległ poważnym zniszczeniom (jak to miało miejsce w przypadku katedry Wniebowzięcia i kaplicy św. Jana) albo jeśli z obiektu pozostały tylko fundamenty (jak to miało miejsce w przypadku monastyru św. Michała Archanioła o Złotych Kopułach w Kijowie).

Na przykładzie omówionego zabytku „Domu z Chimerami" przy ul. Bankowej 10 przedstawiono problematykę rewaloryzacji obiektów oraz procedurę działań konserwatorskich zmierzających do wyeliminowania zagrożeń dla obiektów zabytkowych.