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PRESERVATION AND RESTORATION ISSUES OF THE SALESIAN MONASTERY FAÇADE IN OŚWIĘCIM: LESSONS FROM UKRAINIAN PRACTICE

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Abstract

The article is devoted to the study of the problems of conservation and restoration of facades of historical buildings, considered on the example of the Salesian Monastery in Oświęcim. The main problems that arise in this case and ways to solve them are highlighted. A comparison of facade restoration technologies adopted in Polish and Ukrainian restoration schools and their development during the 19th – 20th centuries is carried out.

Keywords*: Facade; Preservation; Conservation; Salesian Monastery; Oświęcim; Ukraine's experience*

Introduction

The problems of facade restoration are related to keeping the balance of the "substructure-foundation-structure" system, the loss of which causes its emergency state. The emergency state of the building is recorded visually and using geodetic tools – traditional methods of installing benchmarks, dots, and leads. In particular, this way it is possible to trace the dynamics of the appearance and opening of cracks, which is probably a manifestation of uneven subsidence of the bases and foundations and loss of the foundations' bearing capacity and destruction of the wall masonry and masonry mortar. The emergency state is caused by physical and geological processes – earthquakes or landslides—or technogenic factors – laying the metro, construction of underground structures nearby, etc. The rake of the building also indicates problems with the substructures and foundations (most often in combination with the appearance of active cracks, which mainly pass through weakened places – openings, arches, and vaults).

This article examines the problems of facades' conservation and restoration using the example of the Salesian monastery in Oświęcim (Fig. 1).

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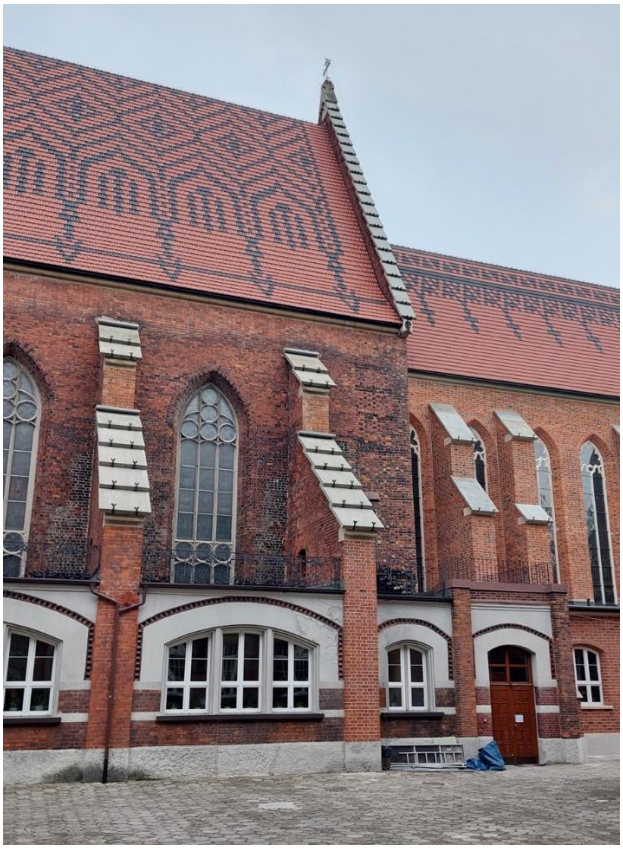

Fig. 1. The Church of Our Lady of the Commemoration of the Faithful, a part of the Salesian monastery complex in Oświęcim.

The Salesian monastery complex with the Church of Our Lady of the Commemoration of the Faithful was built in 1898 on the ruins of a former Dominican monastery.

According to archival sources, the site for the monastery construction was donated in 1291 by the Duke of Cieszyn, Mieszko, with the support of this initiative by his son Władysław.

The Dominican monastery was built in several stages. The monastery was shaped in the medieval style in 1304 and was expanded in different periods. The original shape of the monastery has been preserved in the form of ruins from the end of the 19th century. According to archival evidence, the former church had an elongated presbytery and a slightly wider nave, high escarpments, and pointed arch windows. The Chapel of St. Hyacinth belongs to the original stage of the Dominican complex. Since the Middle Ages, the shape of the church has changed through numerous fires, demolitions, and reconstructions.

The church and the buildings located next to it were repeatedly demolished, and they were in a state of ruin. The oldest building of the monastery from the period 1316–1321 is the Gothic chapel of St. Hyacinth, originally the monastery chapter.

The church was damaged during the fire of the city of Oświęcim in 1519 and in 1656 or in 1655. In 1819, the wooden belfry was dismantled. In 1845, the emergency roof was dismantled, and in the mid-19th century, the church was in a state of ruin. In 1883, stalls were added to the church walls, and in the presbytery and sacristy, there was an oil storage facility.

In 1895, the church was roofless, and there were no glass panes in the windows. Around 1899, the ruins of the church were given to the Congregation of Salesian Fathers.

We can distinguish the following stages of conservation work since the 19th century.

The first stage of reconstruction after 1899 was the reconstruction of the presbytery.

The original structure was rebuilt with a gable roof covered in ceramic ornaments. The vaults were renovated. The brick walls were conserved. The window fittings, cornices, and slope coverings were renovated. The work lasted from 1899 to 1902. Then, there was a break of several months.

The second stage of renovation lasted from 1902 to 1903 to 1906. The concept of rebuilding the monastery area as a whole, rebuilding the nave-side galleries on pillars. A roof with an ornamental, ceramic covering was made. The edges of the gable walls were covered with concrete slabs. Concrete slabs were also used as drip caps, which covered the buttresses. Construction of the altar part.

Moving the main altar to the nave and making an entrance from the street in the former altar wall.

The third stage. After the end of World War II, the wing that had been destroyed during the bombing in 1944 was rebuilt.

The fourth stage lasted from 1975 to 1985. Part of the church was built towards the west.

The fifth stage was in 2006. The roof was completely renovated, with conservation work focused on details.

The sixth stage lasted from 2007 to 2009. A series of conservation works on the northern elevation, presbytery, and nave:

– on the northern wall of the nave – conservation of the brickwork and stonework;

– renovation of the plinths;

– vertical wall hydroinsulation.

The seventh stage lasted from 2010 to 2013. Maintenance of roofs on the south side of buildings and other minor works.

The eighth stage lasted from 2016 to 2019. Conservation of the front, eastern facade (in the chancel). Conservation in the sacristy and chancellery.

The purpose of the article is to compare the practices of restoring facades of architectural monuments of the 19th and early 20th centuries in Poland and Ukraine and to identify the main problems of the state of disrepair and ways to overcome them.

The research objective: to highlight the general problems of restoring the facades of cultural heritage sites and to compare the problems and the search for ways to solve them.

The tasks set determined the choice of scientific sources in the following areas:

– general problems of the emergency state of cultural heritage sites [1], [2], [3];

– technologies for the restoration of cultural heritage sites [4-9];

– publications devoted to the history, stages of development, and restoration of the Salesian monastery in Oświęcim [10], [11], [12].

Materials and Methods

The research objectives required the use of such general scientific research methods as the method of historical analysis, the method of comparative analysis, and the method of system analysis. The method of historical analysis allowed us to investigate the creation and preservation of the unique monastery complex in Oświęcim. The method of comparative analysis allowed us to compare the methods of restoration of facades of historical buildings used in Poland and Ukraine. The method of system analysis allowed us to analyze the cause-and-effect relationship

between the causes of the emergency and the consequences, as well as to determine the list of necessary restoration measures.

Results and Discussion

Condition research

In 2021, a program of conservation works was developed on the external facades of the Sanctuary of Our Lady of Memory of the Faithful in Oświęcim. The company from Cracow, "Markon – Konserwacja Zabytków," carried out the program of conservation works and condition studies.

The description and proposal of conservation works were made based on the examination of the facade components' condition. The facades' condition was analyzed and described according to the following groups:

1. Types of brickwork and state of preservation of plastering;
2. Details:
– cornices;
3. Condition of windows and doors:
– stonework of window frames;
– glazing, stained glass;
– door joinery;
4. Elements protecting against water:
– gutters and drains;
– sheet metal;
5. Condition of the substructure/foundations/dampness, wall cracks, types of coverings of various parts of the church;
6. Metal elements.

Based on the research of these elements, the original materials and their state of preservation were explained. Gothic brick was used on the facades with later additions. Stone elements were also used on the facades: cornices, drip caps, windows, window sill coverings, concrete elements such as slope coverings, and metal, which was used in decorative anchors, balcony balustrades, window elements, gutters, and drains. Traditionally, wooden joinery is used in the doors.

Depending on the research done, the problems were divided into several groups:

– the most important problems related to the statics of the building and the general state of its preservation;

– the condition of the ground, its consistency, and the proximity of the river lead to dampness and salinization of the foundations and walls, which in turn lead to the walls' cracking and dampness of the building's structure (Fig. 2). This also contributes to the appearance of mold, fungi, and plants on the walls (Fig. 3) and the flaking of bricks, etc. This is visible on the northern and southern facades;

– large temperature differences that have been occurring recently, along with moisture, are causing surface defects in the brick and mortar layer (Fig. 4). These factors, as well as environmental pollution, also contribute to dirt that is difficult to remove. They also cause defects in cornices;

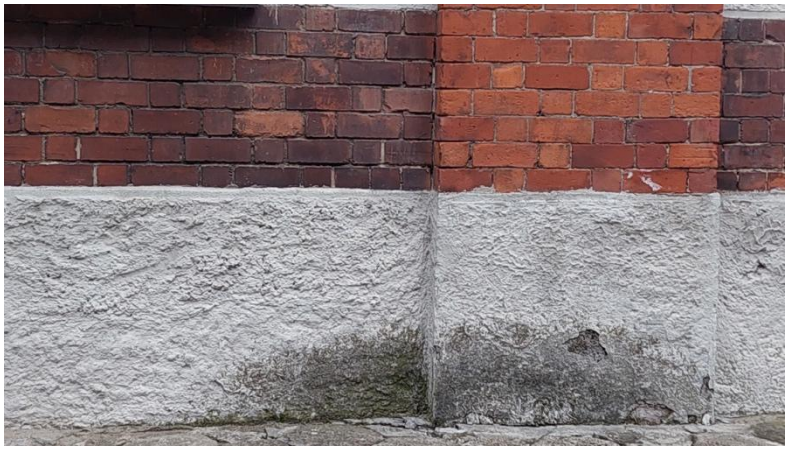

Fig. 2. Moisturizing and salinization of the wall.

Fig. 2. Biological damage to the lower part of the walls.

– rain/water drainage, which has an impact on the entire facility and on details, e.g., drip caps, which are made of dolomite, cracked and delaminated, leading to the destruction of the design and profile of the drip cap;

– unprofessional renovations that are visible on the facade parts in the form of filling in brick threads with cement lime or cement mortar, with weakened cohesion, which causes flaking

of the layer and greater losses of this layer. Lack of professionalism in the execution also contributes to a decrease in the façade's aesthetics;

Fig. 4. Defects in brickwork caused by temperature and humidity fluctuations.

– the passage of time has an impact on metal corrosion in the form of corrosion of flat bars located in the covers of the slopes of the presbytery of the former nave. This problem, combined with the state of the ground, the proximity of the river, and temperature differences, causes dampness in the vault/ceiling, leading to its cracks.

Suggestions for conservation

Based on the research on the state of preservation of the church elements in 2021, the main directions of conservation works were specified:

– renovation of the brick and stone facade with decorative elements;

– renovation of the southern nave, former presbytery;

– renovation of the northern facade and southern nave of the presbytery;

– renovation of the eastern and western gable walls of the presbytery.

The order of conservation works

In the scope of brick bonds, it was first proposed to examine their condition and clean them to remove dirt. It is proposed to apply appropriate chemical components from Remmers or Henkel to the designated damp fragments. After this work, the destructive bricks and joints should be removed, and the remaining parts of the brick bonds should be strengthened with a Remmers preparation. The removed bricks should be replaced with new bricks of similar characteristics. Small places where bricks are missing should be filled with a colored mineral putty. It is also proposed to enrich the lime-sand mortar with a hydraulic additive.

The final stages are the color integration of the brick bonds and their hydrophobization using Remmers materials.

Stone details should be cleaned, weakened fragments removed, appropriate preparations applied to damp surfaces, and the stone structure strengthened with a Remmers preparation.

Then strengthen the stone slabs on the cornices.

New fragments should be made of sandstone. More minor damages should be filled with colored mineral putties. Renew the mortar and improve the color and hydrophobicity to match the original appearance.

Heavily damaged reinforced concrete slabs should be removed along with the anchors, and the places where the old anchors were should be filled with new ones of the appropriate shape.

After all conservation recommendations have been followed, the new covering should be hydrophobized.

Conservation work has also been proposed on the roof tiles on supports located at the chancellery, considering the possibility of their dismantling and replacement.

A separate chapter on conservation work covers the wooden joinery and windows with stained glass, following known conservation technologies.

Since the church in Oświęcim underwent several stages of reconstruction, some of which date back to the 19th and early 20th centuries, it is worth comparing restoration technologies on the facades of objects from this period in Ukraine.

The experience of the Ukrainian restoration school

According to the experience of the Ukrainian restoration school, an engineering and technical inspection of a monument is carried out in the following sequence: the condition of the roof is determined by the degree of damage to materials and elements, and the condition of the roof structures is determined with the determination of deformations and the identification of the causes of their occurrence. Next, an inspection of the condition of the external surfaces is carried out, which begins with an inspection of the condition of the masonry and the identification of destructive factors and an inspection of the condition of the base and foundations while paying attention to hydrogeological changes, the organization of landscaping of the adjacent territory, and the condition of utility services. After that, a survey of the condition of the structures is carried out: the condition of the masonry of the walls is determined, the presence of destructive elements, deformations, and the condition of the finishing layers are detected, and the base and foundations of the monument are examined. During the survey of the condition of the building structures, samples of the original building materials are taken. At the same stage, based on a detailed study of the materials, their chemical composition, and structures, and comparing this data with information about the features, the dates of construction and existence in each historical period of the monument's construction are specified. The nature and causes of destruction are also identified.

After the exterior condition inspection, a technical inspection of the interior condition is carried out, starting from the basement and up to the roof structures. It is intended to determine the condition of the interior decoration and decorative elements and details, determining their condition and the presence of damage.

Based on the data obtained, authentic materials are selected for repair and restoration work on the architectural monument. Based on a detailed examination of the condition of the materials and structures of the monument, a technology for repair and restoration (conservation) works is developed with a comparison of different options for restoration technologies to determine the optimal solution. In addition to a thorough scientific, technical, and engineering examination of materials, structures, and decoration of monuments, a scientific, technological, and biological examination of architectural monuments is also conducted at the initial stage, as it is on its basis that methods of protection and conservation are developed. The process of destruction by biological factors can occur in all building materials, not only in wooden structures. Biodamage can occur in wood, stone, and mortars. Stone, brick, and mortar can be destroyed both mechanically, due to the appearance of microorganisms that settle in pores and cracks, and chemically, when a certain type of biodestructor releases corrosively harmful nitric and sulfuric acid or oxidation products. Biological destruction of stone, brick, and mortar can also occur.

A detailed examination of the condition of a monument can reveal both the presence and causes of destruction, predict the speed of destructive processes, and determine the degree of

danger to the monument. Therefore, all this becomes the basis for carrying out emergency protective measures at the architectural monument.

Before the immediate implementation of repair and restoration works, preventive measures are taken to combat biodamage: the causes of biodamage are eliminated; in particular, moisture is eliminated; biodamaged surfaces are replaced or cleaned; high-quality waterproofing and drainage are arranged; chemical protection of building materials is organized; and some preventive measures are carried out. In the future, during the operation of the monument, it is necessary to ensure a scheduled inspection of its structure both from the outside and from the inside. If new areas of biodamage are identified, work should be carried out in compliance with the optimal temperature and humidity regime.

In ancient buildings, the impact of uncontrolled moistening of foundations due to the action of groundwater on the lime mortar of foundation masonry was practically not taken into account. Weathering of the mortar of foundation masonry, coupled with poor-quality masonry, led to the failure of foundations and the need for their reinforcement or replacement. In ancient times, the properties of bulk soils in which foundations were built without proper deepening were also not taken into account.

The emergency condition of the foundations, most often due to wetting of subsiding soils, leads to the appearance of cracks in the wall structures. Many problems arise in cases where the waterproofing of the building monument is broken or absent: this leads to the “saturation” of the foundation and basement with groundwater and, subsequently, to the wetting of the walls. Rotting also occurs due to the wetting of wooden floor structures.

Where there is a problem of violation of the waterproofing of the monument, its biological destruction occurs, and biodestruction develops. Signs of biodamage are increased humidity levels on the premises, musty air and the smell of fungi and mold, the appearance of destructive stains, dust, subsidence of the floor, etc. This applies only to wooden monuments.

Signs of destruction of stone monuments are increased humidity levels on the premises, the appearance of efflorescence, and “blisters” of plaster. Particular attention is also paid to adjacent materials and structures, since the destruction of the monument may occur as a result of their destruction. Attention should be paid to the condition of wooden structures connected to the masonry, to the presence of cracks and destruction of plaster, to the deformation of the door frame, to checking whether there are any gaps between the ceiling and the top of the partition, etc. The condition of those structures that cannot be determined by direct inspection, visually, is determined by installing soundings.

The component of the foundations and basements is directly related to the component of the wall and its components at different hierarchical levels. This component concerns the study of the causes of the emergency condition of the basement and basement floor; wall masonry; entrance and entrance bay windows, balconies, loggias, bay windows, balconies, wall decor, arches, windows, columns, architrave, frieze, cornice, and tongs; and each of the elements includes smaller components. Each of the components of the first, second, and third levels is subject to restoration using the developed technologies. Therefore, we can say that restoration technologies are also presented in the form of a hierarchical model: we can talk about the general procedure for carrying out wall conservation work and specific, more specialized work: installing horizontal waterproofing, injecting cracks in masonry, removing water-soluble salts from the basement of walls, cleaning the surface of walls and decor from dirt, conservation and restoration of the surface of stone in facing, conservation of damaged wood, etc.

The goal of conservation and restoration of brickwork surfaces is to maximize the approximation to the authentic appearance of the building. Under the influence of aggressive

external factors, the brick peels off, individual pieces fall out, and cracks and efflorescence appear on the outer surface of the brick.

The cause of wall wetting can be the lack of waterproofing, an increase in the groundwater level (especially if it is aggressive water that enters into a chemical reaction with the masonry mortar and leads to its destruction), freeze-thaw cycles of the wall, and roof leaks. For example, the wetting of the brick walls of the basement of the palace in Baturyn occurred due to unorganized drainage, and the walls of the upper tier, due to the lack of a roof. The wetting of the brick masonry of the basement of the Mariinskyi Palace occurred due to the destruction of the blind area and wetting by rainwater, unorganized drainage from the building, and the location of lawns close to the palace; the destruction of the brick masonry of the staircase balconies occurred due to the lack of waterproofing of the floor covering.

Dampness of walls occurs in the case of damage to drainpipes and gutters. Some types of damage are determined visually: in particular, a noticeable slope of roofs or stairs indicates the presence of destructive elements and structures that require replacement. As a result of the settlement of the foundation, cracks appear in the walls, a visual violation of the even line of brickwork, and cases of brick chipping may be observed.

The main reasons for the destruction of walls and old masonry are a violation of the statics of the base-foundation-structure system; changes in hydrogeological conditions; an increase in the groundwater level with an aggressive environment in which lime mortar cannot be effectively used; unorganized drainage or an emergency condition of the roof; aging of masonry mortars; a decrease in the strength and load-bearing properties of stone, brick, and plinths; an increase in the load on the wall due to reconstruction and the construction of additional floors; and changes in the functional purpose of the building and, as a result, the placement of equipment in the building that creates vibration.

In the building of the National Philharmonic of Ukraine (formerly Merchants' Assembly, 1882), the facade was originally unpainted, and the facing was made of yellow Kyiv clay brick with brick decor made of patterned brick on lime-sand and lime-cement-sand mortar; later, the facade was painted (Fig. 5).

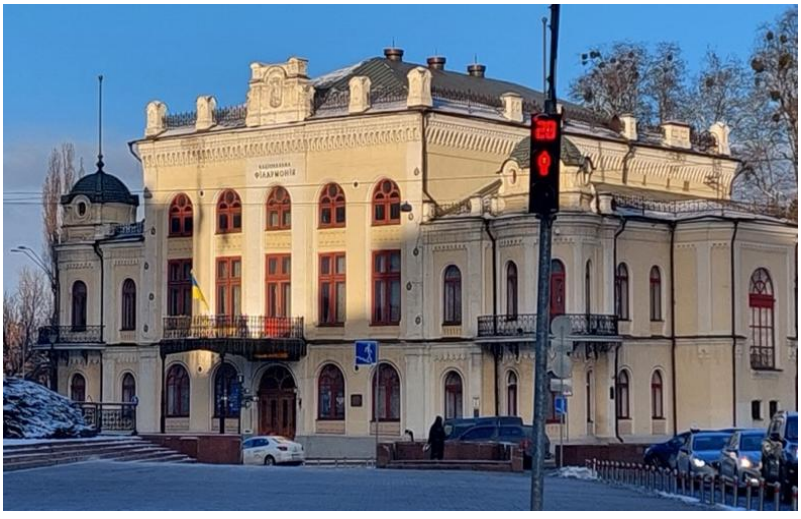

Fig. 5. The building of the National Philharmonic of Ukraine. Modern view.

The main problems of the emergency state of the walls were associated with the appearance of through cracks, destruction of the masonry mortar, damage and contamination of bricks and rows of masonry with peeling plaster and moisture, and biodegradation. The main cause of the emergency state of the building was uneven subsidence of the foundations and substructures, which led to deformation of the walls and the heels of wooden columns and beams; subsidence reached 25-32 cm in some places. The causes of the emergency state were atmospheric moisture from paving, temperature drops, and impaired drainage.

Restoration measures were aimed at eliminating the deformation of the foundations (the foundations and substructures were reinforced with bored piles). The old roof covering was replaced, and the load from the roof and ceiling was transferred from the old wooden columns to the brick walls. The brick plinth, brick surfaces, and brick decor between the plinth and the crowning cornice were restored, and the brick surfaces of the ends were restored. The emergency condition of the walls of the Bessarabskyi quarter was caused by waterlogging of the substructures and foundations and the destruction of the roof and ceilings. The methods of strengthening the walls were as follows: corsets made of metal ties were placed on the historical “frames” of the emergency walls, which tightened the walls with numerous cracks. In addition, the walls were reinforced with a metal mesh, on top of which a concrete “jacket” was placed (Figs. 6-8).

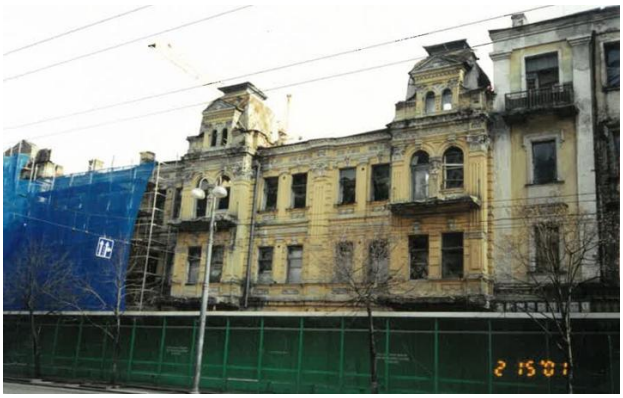

Fig. 6. Bessarabskyi quarter in Kyiv before the start of restoration (2001)

Fig. 7. Condition of the walls of a building in the Bessarabskyi quarter in Kyiv before the start of restoration (2001)

Fig. 8. Bessarabskyi quarter in the reconstruction process with restoration of authentic parts (2001)

Conclusions

General strengthening of walls and strengthening of brickwork in many cases allows for the elimination of the emergency state of buildings; however, these works should, as a rule, be carried out together with measures to strengthen the foundations and substructures, which are in many cases the root cause of wall deformation. In some cases, it is necessary to first strengthen the walls (the above-ground part of the building) and then proceed to strengthen the foundations and substructures (the underground part of the building).

Methods of strengthening brickwork are as follows:

1) Re-laying of brickwork of walls (if the loss of bricks exceeds 1/3 of the thickness of the masonry fragments, with the removal of destructive parts and the insertion of new brick fragments) is performed by highly qualified bricklayers. In the presence of stone facing, the existing condition is consolidated by appropriate engineering and chemical-technological measures (tightening of stone blocks with metal bandages, prosthetics, filling, thorough injection, etc.) (St. Volodymyr's Cathedral in Chersonesos).

2) The arrangement of the outer frame of the "corset" with bandage metal ties, which prevents horizontal spreading of the masonry, its delamination, and off-center compression (Besarabskyi Quarter). The disadvantages of this method of strengthening the walls of architectural monuments include the presence of metal strands on the facades or in the interior; the possibility of corrosion and weakening of bandages and ties; and the concentration of loads on brick walls, leading to creasing in the places where the bandage is attached.

3) Replacement of load-bearing elements of walls and piers of brick masonry with concrete or metal frame (the old masonry serves as cladding) ("House with Chimeras" at 10 Bankova Street, Assumption Cathedral of the Kyiv Pechersk Lavra – reinforcement of the brick masonry of the pylon—"reinforced concrete jacket").

4) Injection of brick or rubble masonry with mortar (cavities in the masonry are filled, joints (seams) between stone or brick are sealed, destroyed mortar is restored, and the permissible load on the masonry is increased (St. Sophia's bell tower – strengthening of the wall of the eastern facade).

5) Reinforcement of brick masonry with cementation (Italian method "cemented mesh" – "raticolo cementato") is carried out to increase the strength and stability of the structure and counteract tensile forces by introducing steel reinforcement into the wall through wells that are filled with mortar (facades of the bell tower of St. Sophia). This increases the permissible forces on the masonry and restores the structural integrity of the masonry. The steel reinforcement rods are firmly connected to the masonry in which they are cemented. The volumetric integrity of the reinforcing mesh is ensured by the fact that the reinforcement included in the masonry overlaps with each other. The more damaged the wall, the easier it is to strengthen it with this method;

6) Replacement of destructive and significantly salted bricks. Capillary moisture and moistening of the stone more than 5% with saturation of the stone with salts lead to destruction; humic acids in capillary water and salts of chloride, sulfate, sodium, calcium, and magnesium crystallize into efflorescences.

7) Strengthening of brittle bricks by puttying the outer surface of the cavities and filling the joints is carried out if the dimensions of the cavities are less than 5 cm (Mariinskyi Palace).

The detailed procedure for applying certain wall strengthening methods is as follows.

Injection work is carried out in the following sequence:

– clean the wall joints and fill them with cement mortar and point up;

– after the mortar hardens, holes (wells) with a diameter of 20 – 40 mm are drilled in the masonry joints and in the walls themselves at an angle of approximately 200 from the horizon with a step of 500 mm and, as an option, reinforcement (with a diameter of 20 mm) is inserted there for better connection of the walls;

– fix the pipe for the injector;

– feed the mortar into the wall under pressure with the injector. Injection is carried out in two stages with a time interval between stages of no more than 48 hours;

– to maintain statics, the work is carried out carefully in stages with the adjustment of the amount of mortar in one operation. The filling of the wells is considered complete if a column of dense, thick mortar is formed in the wells (cracks) or the solution is not supplied to them under a pressure of 0.3 – 0.5 MPa. To prevent the cement mortar from "settling," bentonite is added in a proportion of 2 – 3% of the weight of the cement. In Kyivan Rus masonry, lime with cement was used as a binder in the mortars; therefore, the mortar for injections is often selected similarly.

The injection of brick and rubble masonry foundations is carried out with cement mortar; this cementation is vapor-impermeable. Injection of the facade wall's brickwork preserves its vapor permeability and is performed in two stages:

a) with a more liquid lime-cement solution 1:0.7 and then 1:1; in addition, 10 – 30% slaked lime is added;

b) 10–30% white stone dust is added to dry walls, and brick dust (1 part lime, 1/3 part finely ground brick, 1 part cement, and 2 parts sand) is added to the wet walls, ground in a wet state, and filtered through a sieve.

To reinforce brick walls in Italy using the "Raticolo cementato" ("cemented mesh") method, as a rule, 3–4 wells are made per 1 m² of wall, with the length of one well being three times the thickness of the wall.

To seal cavities in bricks, ready-made mixtures from German companies "Caparol", "Henkel" are used, or the following composition is prepared: lime dough – 1 part, brick dust – 3

parts, cement – 0.5 parts, iron red lead to the desired color, and polyvinyl acetate emulsion 25% by volume of water.

The nature and extent of the damage determine the method of brickwork restoration: sometimes destroyed bricks are replaced with similar new ones, and sometimes fragments of loss are supplemented with special solutions. Before this, the surface of the brickwork is cleaned of dirt and efflorescence, and old paint layers are removed, after which they proceed to puttying chips and cavities in the surface layer of the brick and filling the masonry seams with mortars close to authentic ones.

Loose, brittle brick is fixed with reinforcing solutions based on polymer materials, and the surface of the brick is coated with hydrophobic substances.

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