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The significance of object restoration in the urban environment and restoration basics

Znaczenie przywrócenia obiektów w środowisku miejskim i podstawach restoracyjnych

Abstract

This article deals with the issue of the significance of architectural monuments in the urban environment. It defines the criteria that single out the most significant objects with regard to urban planning and architectural aspects, where the specialists of the Ukrrestavratsiia (Ukrainian restoration) Corporation worked. The experience of the restoration of architectural monuments is analysed.

Keywords: urban environment, architectural monuments, conservation, restoration

Streszczenie

Artykuł porusza kwestię znaczenia zabytków architektury w środowisku miejskim. Określa kryteria wyróżnienia najważniejszych obiektów w odniesieniu do urbanistyki i aspektów architektonicznych, w których pracowali specjaliści Korporacji Ukrrestavratsiia (Ukraińska Konserwacja). Przeanalizowano doświadczenie renowacji zabytków architektury.

Słowa kluczowe: środowisko miejskie, zabytki architektury, konserwacja, restauracja

1. INTRODUCTION

Architectural monuments play a key role in the historical urban environment and they are usually considered to be symbols of their cities – the Eiffel Tower in Paris, the Colosseum in Rome, the Saint Sophia and the Assumption cathedrals in Kyiv. Often, as a result of barbaric human actions, these objects have been destroyed, and then the historical urban environment becomes seriously damaged. This happened in Kyiv, when, as a result of the destruction of the St. Michael's Golden-Domed Cathedral in the 1930s, the centuries-old historical axis of the Kyivan Russ between the bell towers of St. Sophia Cathedral and St. Michael's Golden-Domed Monastery was destroyed; during World War II, the main shrine of All Eastern Orthodoxy, the Assumption Cathedral of Kyiv-Pechersk Lavra, was blown up, which was one of the architectural dominants of the historical landscape of Kyiv. Despite the significant number of restoration objects in which the specialists of the Ukrrestavratsiia Corporation worked, there are several objects that meet the criteria necessary for them to be classed as being of particular significance not only in architectural terms but also with regard to town-planning:

- They play an important role in urban or village development (ideological, town-planning).
- They represent the most numerous by function or period group of monuments that are included in the State Register.
- Problems of their critical condition are the most characteristic or were extremely complex and required a non-standard emergency response and restoration measures.
- The most characteristic or unique materials, structures, ornamental finishing were used for these objects.
- During the restoration of these objects, unique techniques and technologies were used.
- The experience of the restoration of these objects can be extended to other attractions in Ukraine and abroad.

The buildings of the National Philharmonic of Ukraine and the Odessa Opera House were the most complex reconstruction objects and they have become the real laboratory of the search for new techniques and technologies.

2. RESTORATION OF THE NATIONAL PHILHARMONIC OF UKRAINE

The Merchants' Assembly Club (the Merchants' House) was built in 1882 according to the design of V.M. Nikolaiev, the famous Kyiv architect, in the Russian-Byzantine style of the second half of the nineteenth century. The building is notable for its non-standard volumetric and spatial

composition and original silhouette, as well as its unique acoustics (Fig. 1). The exterior wall decor was made in brick with subsequent staining with lime paint in two colours. The interior of the hall was marked by extreme expressiveness; coupled wooden columns of the Corinthian order supported the balcony of the second tier, and the Tuscan columns of the second tier above them were crowned with classical cornice with dentils and egg-and-dart mouldings¹. The blind balustrade of the balcony was decorated with stucco garlands and cartouches; the plafond was decorated with stucco phytomorphical moulding and a ceiling centre rose for a chandelier.

The auditorium is covered with a mirror vault on a ceiling border, dissected by rectangular caissons. Along the perimeter of the auditorium, there was a gallery of up to 4 m with supporting structures – two-tier coupled columns, ledger strips and tie beams in the form of timber bars. The ground floor foyer is arched over with profiled beams². The basement ceiling is flat reinforced concrete and finely vaulted concrete along steel rolling beams. The interfloor constructions and garret floor were built on wooden beams. The foyer ceiling was supported by longitudinal-bearing brick walls with three-centred archways, and on two rows of cast-iron columns with consoles³. The roof constructions are wooden triangular trusses with a raised chord along which the suspended ceiling of the concert hall is made⁴. The main staircase is marble, black – granite.

As a result of the above, we can say that the building of the Merchants' Assembly Club is a characteristic object of the second half of the 19th century in its architectural, stylistic and constructive solution and decorative elements and methods of decorating facades and interiors. The problem of its critical state was related to the fact that as a result of accidents of the water supply and sewage systems, the balance of the 'footing-foundation-building' system was disturbed, basement deformation occurred, and this led to the occurrence of through-traversing/full-depth cracks in the exterior walls and deformation of the floors by up to 20 cm vertically⁵. The vaults of the hall and the ceilings of all the rooms were covered with cracks, the plaster crumbled and the destruction of wooden elements was observed⁶. The vaults of the hall and foyer were noticeably deformed with vertical displacement of some sections being up to 20–25 cm. Due to the subsidental deformations of the foundations and basement, subsidence of the gallery columns, ledger strips and tie beams of the gallery was identified; in some places, there was subsidence of up to 30 cm. During visual inspection, it was found out that the wooden elements of the suspended ceiling and the trusses were damaged by wood-destroying insects and, during previous repairs, they were already strengthened by padding overlays and the installation of additional metal and wooden elements⁷. Due to sedimentary deformations, the wetting of roof elements and garret floors occurred.

The original external appearance of the main facade was also mangled: the balcony over the main entrance was demolished, two balconies of the first floor on the corner semi-circular avant-corps were not preserved, the decorative finishes of cupolas were lost during repair and the form of the coating was changed – 30% of the original appearance was lost.

As priority measures, it was proposed to eliminate deformations of the footings and foundations of the building (taking into account the fact that the base was loose filled soil and the foundations were shallow lying, which resulted in the deformations), to stabilise the deformation processes and to conduct comprehensive repair and restoration work on the monument⁸. The footings and foundations were strengthened with needle piles and jacked piles. In order to restore the firmness of masonry of the walls, it was proposed to use the Italian method 'reticolo cementato' (stitching) - to inject open cracks with mortar and to reinforce masonry. We used the prosthetic method and managed to level the deformed constructions which were not subject to replacement on account of the acoustic properties of the hall (first of all, all wooden columns and beams). On the main façade, all the lost elements and the cartouche with the Archangel Michael on the pediment were restored; the ceremonial marble staircases were decorated with marble figures of Apollo and Aphrodite in decorated niches; a marble fountain with a cherub appeared in the centre of the foyer. In November 1996, the National Philharmonic building was put into operation.

3. RESTORATION OF THE ODESSA NATIONAL ACADEMIC THEATRE OF OPERA AND BALLET

Odessa Opera House (Fig. 2) is an example of an object of restoration of extraordinary complexity, taking into account the conditions of construction, the uniqueness of the decorative finishing, most critical conditions of all structures and the ornamental finishing.

The unique building of the Odessa National Academic Theatre of Opera and Ballet, as the pinnacle of the architectural dominant of the historical and cultural centre 'Old Odessa', with an audience hall for 1600 people, was built in 1884-1887 upon the design of famous Viennese architects Ferdinand Fellner and Hermann Helmer and it is considered their best object, the second theatre in Europe after Vienna Opera and the fifth in the world. The facades and interiors of the Odessa Opera House are marked by the uniqueness of their decorative finishing. The facades, originally painted in golden brown with accents in the loges, were in the style of the late Italian Renaissance with baroque elements, the interiors of the spectator rooms were in the style of the late Viennese baroque and French Rococo. Light crystalline limestone (columns, parapets of loges and portico fences, covering plates, balusters) was used to decorate the facades of the theatre. Limestone-shell rock was used in the imposts of the openings in the loges. Three-tiered, magnificently decorated facades of the spectator's part along the main axis were interrupted from the south side by a two-tiered portico with an attic – the main entrance to the theatre. This part of the theatre was most luxuriously decorated. The eastern and western facades were accentuated with one-tiered, three-arcaded porticos above the entrances.

The sculptural and decorative finishing of the facades was made from artificial stone, all 42 compositions personified the muses of art. The covering of the cupola over the spectator area was made from a zinc sheet with numerous decorative elements.

A complex rich rocaille ornament combined with gilding adorned the five-tiered audience hall; the stairs, the foyer and the ceiling of the hall were decorated with scenes from Shakespeare's plays. In the centre there was a large bronze chandelier with crystal pendants. Mosaic floors with stylized floral ornament were arranged in the spectators' area. The sketch of the theatre drop-curtain was designed by the famous artist F. Golovin. In addition to the unique decoration, the hall was noted for its remarkable acoustics.

The theatre was built on a complex relief in such a way that the spectator section (hall, foyer, gallery), in the form of a huge horseshoe, is located on the flat part of the plateau, along the axis of one of the main streets, and the stage part, recessed in the natural slope, had a cubic shape and a service facade went out on the small, secondary P.I. Tchaikovsky Street.

The building was built on strip foundations of limestone, 0.6–2.4–4.0 m wide, with the lower portion being rubble masonry.

The first problems with the cracks already occurred during brickwork, and after 13 years of operation of the theatre, the building needed repair. Serious deformations appeared in the theatre building in 1900, when, as a result of settlement by 17.7 cm of the eastern part of the building, cracks appeared in the walls, arches, floors and ceilings. At the same time, works on expanding the foundations were performed in the south-eastern part of the theatre, but these measures did not bring any effect, the deformation processes continued. As early as 1903, the subsidence of the walls of the tiers was up to 20 cm and the slope of the floors of the foyer and corridors was observed.

In 1918–1919, the pylon of the portal wall of the stage subsided; due to leakage of water-pipe lines in 1927, new cracks appeared on the walls of the stage and in the eastern part of the foyer. In 1925, after a fire, a heavy lifting and lowering fire curtain was installed, and this caused the appearance of additional cracks in the portal wall. New cracks together with the cracks due to subsidence of footings and foundations led to the building's critical condition.

In the 1980s, the entire building was in the most critical condition; it split into 36 separate blocks, the slope of the walls towards the sea was 20 cm, the opening width of numerous cracks was 6 cm, the floor beams of the second and the third tiers moved and subsided by 30 cm. The surveying of the state of the building in the years 1997 and 1998 showed that the deformations did not stop.

Research from 1997–1998 defined the following causes of uneven subsidence of the theatre building and the occurrence of deformations:

- complex configuration of the theatre plan, the absence of expansion joints, insufficient rigidity of the building and reinforcement elements;

- the presence of a layer of loessial soil under the foundations with their periodic moistening; intensive geological processes – flooding, subsidence through the bulk soils and rise of the groundwater level, karst phenomena;
- the ineffectiveness of the use of strip foundations of various widths and depths and the opposite effect of foundation strengthening by the method of silicatisation;
- the presence of the heavy fire-fighting equipment of the stage box for which the building was not designed.

Conclusions about the consequences of the critical condition of the footings and foundations were formulated as follows:

- 1) During its lifetime, the building has been subjected to numerous deformations, as a result of which, cracks appeared in its components.
- 2) The appearance of cracks in the walls led to a split of the building between the stage and spectator sections and the division into four parts of the walls of the spectator section.
- 3) Deep longitudinal cracks were fixed on the ceilings of the tiers, the ceilings shifted along the annular walls resulting in the formation of annular cracks. The floor of the foyers of the tiers leaned towards the outer walls.
- 4) Due to the subsidence and destruction of the outer annular walls, the floor beams of the second and third tiers moved out of the supporting sections of the masonry, the supporting areas laying under the beams were destroyed, and as a result, the beams subsided by 30 cm.
- 5) On the radial trusses of the ceiling, the plates on the columns to which the trusses are attached were curved and swollen. An annular metal I-bar along the top of the wall of the auditorium, on which the trusses of the upper ceiling rest, broke along the line of the bolt holes.
- 6) The beams of the monolithic ribbed slab of the covering of the stage area enclosure in the places of the basing upon the walls of the stage there were numerous cracks and chips with a width of opening of up to 20 mm.
- 7) At the time of the survey, the north-eastern corner of the theatre building was 175 mm below the north-western corner. The largest subsidence was fixed at the eastern foyer and was 375 mm. All the stairwells of the spectator part were tilted towards the south. The portal of the main entrance was tilted towards the south and east by 200 mm and the walls of the scene have a slope in the northeastern direction by 200 mm.
- 8) Corrosion of metal structures is observed in some rooms.
- 9) Progressive deformations led to the critical condition of the supporting structures and assemblies, and to the critical condition of the ornamental finishing. The critical condition of the building was considered dangerous for people.

It was found that the foundations of a complex configuration, mainly without expanding the footing of an average width of 1.4–1.5 m, have different depths, the difference in elevations within the building is up to 4 m. During the operation period of the theatre, the

building suffered uneven subsidence (about 30 cm) and deformation of the underground part, which led to the appearance of cracks.

Since 1887, the facades have been repaired 5 or 6 times. The sculptural decoration of natural limestone and metal-reinforced artificial stone, the colour of which was almost identical to the natural stone, suffered greatly under the influence of climatic conditions, in particular, all sculptures suffered losses and cracks, and the outlines of the sculptures suffered as a result of weathering. Corrosion of metal reinforcement accelerated the destruction of the sculptures.

The specific feature in the building of the Odessa Opera Theatre was the use of various types of 19th-century ceilings. This has already been discussed in Chapter 3: ceilings of the monolithic reinforced-concrete ribbed slab, floors of metal trusses of complex configuration, brick vaults along metal beams, metal plate flooring on beams filled with the rest of the cut limestone with lime mortar, monolithic reinforced concrete floors. In the Odessa Opera House, several types of 19th century roofs were used: a roof made from roofing metal, a roof made from sheet zinc, and a roof made from galvanized steel roofing sheet.

For elimination of the critical condition of the Odessa Opera House building, we identified the priority measures aimed at stabilisation of the spatial stability of the building, strengthening of the long-span supporting structures of the flooring of scenic openings of party walls and long-span ceiling trusses of the auditorium and the structures of monolithic reinforced flooring in all sanitary facilities; the ceiling structures of all tiers and the ceiling frames of loges and balconies, accident response and recovery, the prevention of emergency situations, ensuring the further operation of the building, compliance with the modern standards and requirements for theatre buildings, to begin with strengthening of footings and foundations, basements and ground structures of the main portico of the stage box and their protruding gable parts. Partial rebuilding of the vaults was envisaged in the western emergency portico⁹.

4. GENERAL CONCLUSIONS

The peculiarities of the building of the National Philharmonic of Ukraine, built in the so-called Russian-Byzantine style, are its non-standard volumetric and spatial composition, original silhouette, unique acoustics and extreme expressiveness of the auditorium.

The problems were as follows: the violation of the static of the 'footing-foundation-construction' system because of accidents relating to the water supply and sewage system that led to the deformation of the foundations, and then to the deformation of the walls, vault of the hall, floors and ceilings that were covered with through inclined cracks (mainly in the middle parts), there was a subsidence of the gallery columns, ledger strips and tie beams of galleries, plaster crumbled, in some places, there was a shift of masonry along

the cracks. During the existence of the building, there were losses of some elements of the main facade – 30% of the original appearance was lost. Due to sedimentary deformations, the wetting of roof elements and garret floors occurred, and wooden elements of the suspended ceiling and trusses were damaged by the wood-destroying insects.

The primary measures were as follows: elimination of the deformation of the footings and foundations of the building by strengthening with needle piles and jacked piles; restoration of solidity of masonry walls by the mortar injection of open cracks, annealing of the deformed structures which could not be replaced due to the acoustic properties of the hall (primarily, all of the wooden columns).

The peculiarities of the structure of the Odessa Opera House are as follows: the harmonious combination of the late Italian Renaissance style with baroque elements on the facades, the late Italian Baroque and French Rococo styles in the interiors of the spectator rooms, the unique decoration and non-standard volumetric and spatial composition.

The problems were as follows: deformation and subsidence of the building; the occurrence of cracks in the walls, arches, floors and ceilings; sloping floors of the foyer and corridors; sedimentation of the pylon of the portal stage wall. Due to the leakage of water pipelines, new cracks appeared on the walls of the stage and in the eastern part of the foyer. The establishment of a heavy lifting and lowering fire curtain led to a dynamic impact on the walls of the stage and to the appearance of additional cracks in the walls of the portal wall and to its critical condition, the destruction of individual elements. Due to the critical condition, the building was covered with cracks everywhere, it split into 36 separate parts, its inclination towards the sea was 20 cm and the width of crack opening was 6 cm. As a result of the subsidence of the foundations of the second-third tier beams shifted and subsided by 30 cm. All theatre porticoes were in a state of disrepair. In the interiors, permanent deformations of the supporting structures were observed from 1991 to 1998.

The causes of the critical condition were as follows: the complex configuration of the theatre plan; the absence of contraction joints; insufficient rigidity of the building and reinforcement elements; the presence of a layer of loess soils under the foundations with their periodic moistening; intensive geological processes – flooding, subsidence through bulk soils and rise of the groundwater level, karst phenomena; the inefficiency of the use of strip foundations of various widths and depths and the opposite effect of silicatisation; the presence of the heavy fire-fighting equipment of the stage box for which the building was not designed.

Primary measures were restricted as follows. Since the method of the foundations strengthening by the method of silicatisation had no effect, the measures were aimed at stabilising the spatial stability of the building by, first of all, strengthening with needle piles together with jacked piles of the footings, foundations and superstructure of the main portico of the stage box and their protruding gabled parts. In the western emergency portico, partial rebuilding of the vaults was envisaged as was strengthening of the long-span

supporting structures of the flooring of the stage openings of the party walls and long-span ceiling trusses of the auditorium, the structures of monolithic reinforced flooring in all sanitary facilities; the ceiling structures of all tiers and the ceiling frames of loges and balconies, compliance with the modern standards and requirements for theatre buildings. Reinforcement of the front walls of the spectators' area was provided for, as was: reinforcement of the suspended ceiling and the ceiling of the auditorium; strengthening of the structures of the lateral porticos; strengthening of the supporting structures of floors of the second and third tiers; strengthening the structure of the portal wall; restoration and reconstruction of the decorative finish; compliance of engineering networks and internal planning with current regulations; renovation and reconstruction of the theatre square.

To preserve the unique acoustics of the auditorium, only old finishing technologies and traditional materials were applied.

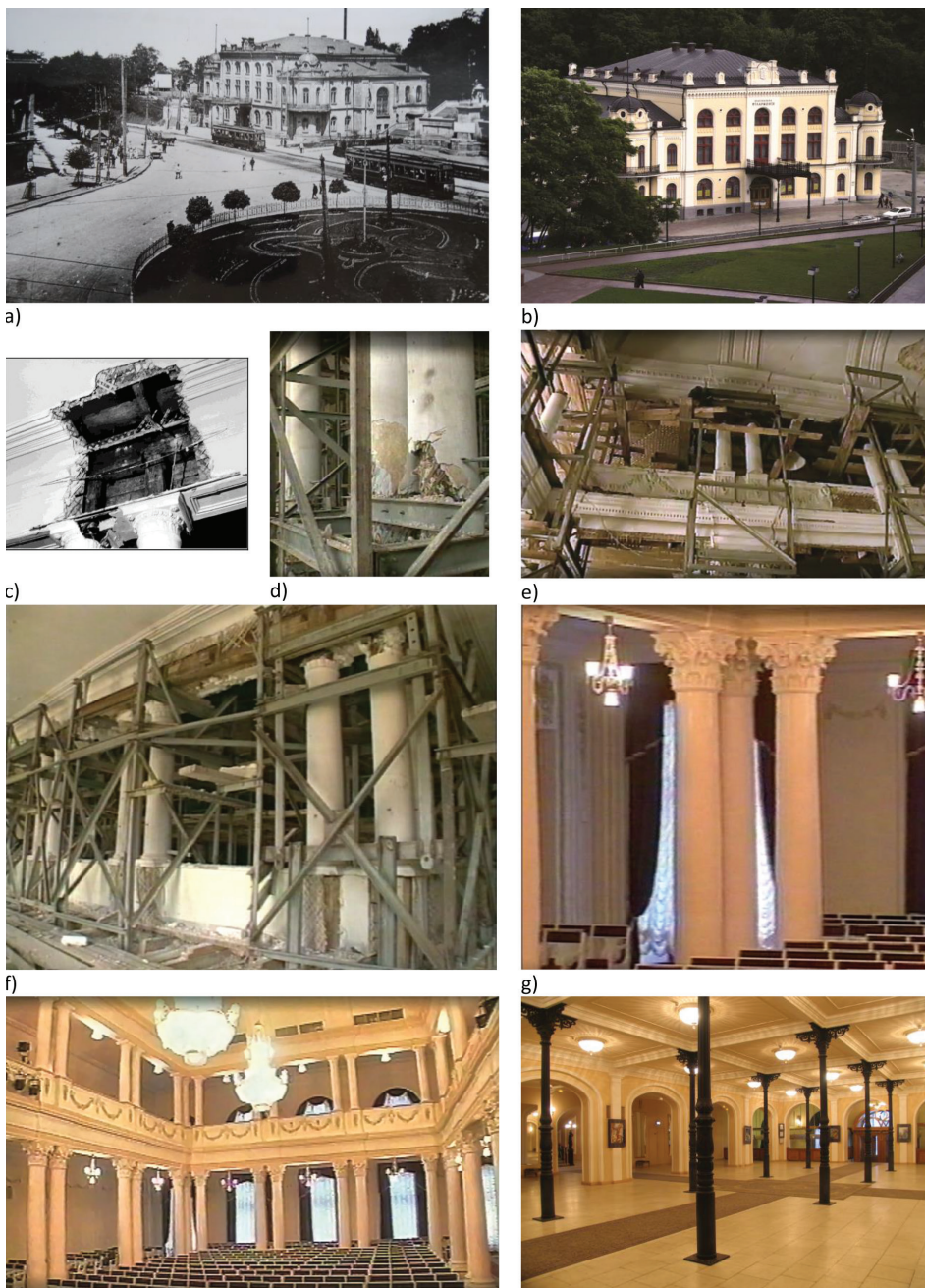


Fig. 1. The National Philharmonic of Ukraine: a) archival photos of the 19th century; c-f) before the restoration; b, g-i) a modern look

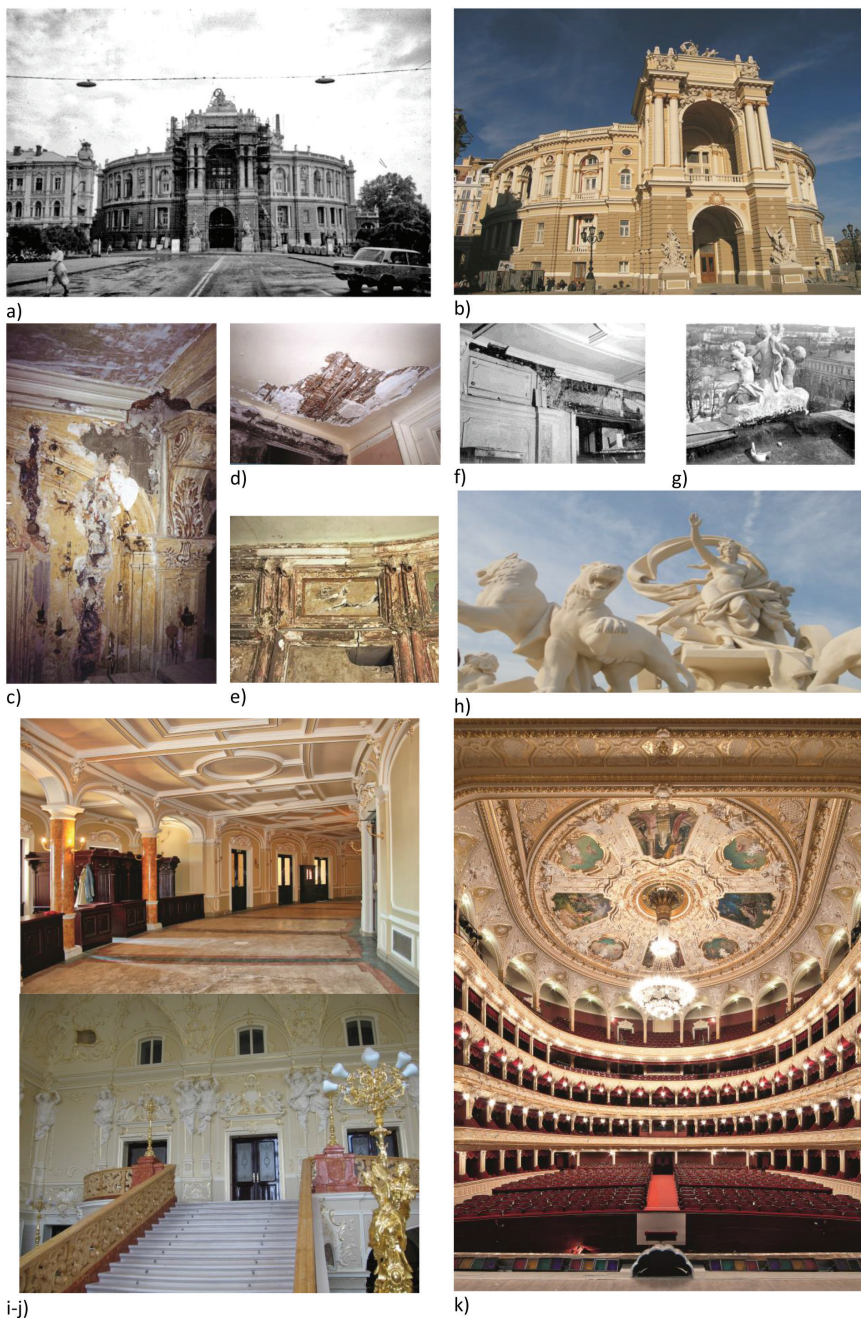


Fig. 2. Odessa National Academic Theatre of Opera and Ballet
 a) archival photos of the 19th century; c-g) before the restoration; b, h-k) a modern look

PRZYPISY

- ¹ *The architectural monument of the late 19th century, 1882*, National Philharmonic of Ukraine; technological inspection of facade finishing; technology of repair and restoration of facade finishing works; injection of the walls; previous works; sketch project of restoration; the architectural part; history reference; complex field surveys, Kyiv 2011, p. 72.
- ² *Ibidem.*
- ³ *Ibidem.*
- ⁴ *Ibidem*, p. 79.
- ⁵ *Ibidem*, p. 67.
- ⁶ *Ibidem*, p. 132.
- ⁷ *Ibidem*, p. 80.
- ⁸ *Ibidem*, pp. 74, 132.
- ⁹ *The architectural monument of the 19th century Odessa National Academic Theatre of Opera and Ballet. Restoration project, stage II. Working draft. Design proposals for the restoration of interiors. East portico. A comprehensive program to preserve the building of the Opera and Ballet Theatre in Odessa*, Kyiv 1995–1998, p. 142.

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