Technical Problems Connected with the Adaptation into a Loft of a Post-industrial Building. Case Study

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Abstract. Adaptation of post-industrial facilities for modern residential buildings improves the results and aesthetics of urban spaces with a full respect for the protection of cultural heritage. Adaptation of post-industrial of the historic building requires a series of the preliminary research facility. The article presents the results of the diagnosis of the technical condition preceding the adaptation of the former factory to lofts in Zielona Góra. The building at Fabryczna 14 in Zielona Góra was built in 1913 and for over 60 years, it was a weaving mill in a textile factory complex. In the 70s of the 20th century, the building was adapted to the office of the "POLON" Nuclear Apparatus, in the first years of the twenty-first century, the building served as a commercial facility and storage. The building is 4-storey, made of solid brick, covered with a desktop roof, with a 5-storey corner tower from the south. The building's facades are made of non-plastered bricks, have numerous profiling - pilaster strips, cornices, bands, panels. From the north, in the 70s of the 20th century, a part containing the reinforced concrete staircase was added. The interior of the building is three-tract, the supporting structure is made of longitudinal brick external walls and parallel steel beams based on cast iron pillars. The main assumptions of the adaptation to lofts primarily assumed changes in the interior of the building. Flats with an area of 60 to 150 square meters were designed, for this purpose, additional transverse walls were made. The brick façade remained, the attachment for the staircase and elevator was changed. At this point, the architect used modern trends related to modern technologies and finishing materials. The projection housing the new elevator and staircase was made of a steel structure with a reflex glass cladding. Modern solutions have been integrated into the brick architecture of the historic building. The political and social changes of the 1990s meant that many industrial facilities, often with a rich history, were out of use. A prolonged break in the use of buildings often causes irreversible degradation of their construction. This is mainly due to the neglect of basic maintenance principles.

1. Introduction
The architecture of a city is a continuously changing picture. New building structures, usually residential, are continuously being created. But the beauty of the city is created by all of these structures, new buildings, as well as those dating further back; beauty lies in the original style of modern forms, but also in the sentimental relics of the past. Modern-day additions, when it comes to aesthetics value, are in harmony with buildings of the past and do not blur the differences between that which is new and that which is old. The idea behind modernization and adaptation is to combine the historical magic of relics with the language of contemporary architecture in common dialogue. The interiors of historical
objects subjected to renovation which incorporates contemporary details into the historical design one-of-a-kind. The original ceilings, columns, woodwork, balustrades or brick walls combined with bold lines and bright modern colours of modern-day solutions give the interiors a unique character. Connecting history with the contemporary ideas of a designer results in the creation of inimitable objects. The coexistence of landmarked buildings and modern architectural forms is currently an inseparable element of the landscape.

In the modern-day world, the protection of cultural heritage is connected with the needs of the civilization. Historical objects are used. The modernization of historical structures and their adaptation to modern needs is inevitable: "Modern-day conservation doctrine is based on changing the emphasis from instrumental to more personal treatment of a relic, the concept of which evolves over time, nowadays signifies not only an increasingly extensive scope of protection but also the multiplication of meanings which this relic is a carrier of" [1]. Dynamic changes taking place around the world and technological advancement are completing the guidelines of the Venice Charter. General assumptions regarding the different approaches to handling relics of course remain. The rules of fully respecting the original substance or choosing solutions which do not harm the object are always current. The rule of minimal interference calls for maintaining form and substance. However, it does not exclude introducing contemporary elements. These elements may not distort the historical content. The following rule regarding the clarity and distinctiveness of the insertions also allows for contemporary additions. The modernization and adaptation of historical objects is the result of ever-changing human needs. Adapting post-industrial objects in residential areas for modern-day uses has become something of a trend. The beauty of a historical building, however, has made it so that the changes carried out in the object are small. The introduced novelties are essentially fitted into the existing architecture.

The needs of civilizational development, as well as spatial changes of cities, have made for a trend of adapting post-industrial buildings to serve modern-day service needs. Buildings derived from past centuries continue to be in use, most often being flats, and the current functional standards do not destroy the historic fabric [2-5]. The first lofts were created at the beginning of the 20th century in Paris, where artists adapted old factory buildings into their studios. In London, abandoned port warehouses were inhabited. Lofts also became popular in the USA, where in the ports of Boston and New York, artists began to adapt ware-house buildings into their flats and studios [6, 7]. The trend for lofts reached Poland near the end of the 20th century, along with the emergence of abandoned buildings following the closing down of factories in Łódź, Warsaw, Poznań or Kraków [8-10]. Also in Zielona Góra were exclusive flats created in abandoned factories. The first lofts emerged on Fabryczna St. 14 in the old POLON industrial building.

2. **POLON – first lofts in Zielona Góra**

The building on Fabryczna 14 St. in Zielona Góra was erected in 1913 and, for over 60 years, was a weaving department in a textile factory complex. In the 70s of the 20th century, the building was adapted into offices of „POLON” Experimental Department of Nuclear Apparatuses in the first years of the 21st century, the building served trade and warehouse functions (figure 1). A view of the building following the adaptation has been presented in figure 2.
Figure 1. POLON building prior to adaptation

Figure 2. POLON building after adaptation into lofts. View from the north-west

The building is 4 stories high and is made of solid brick, covered by a pent roof with a 5-storey corner tower on the south side. The elevation of the building was made from non-plastered brick, with numerous profiling – lesenes, mouldings, bands, and panels. From the north side, the part of the building containing the reinforced concrete stairwell was added on in the 70s of the 20th century. The interior of
the building is on a three-bay plan. The load-bearing structure is longitudinal outside brick walls, as well as steel binding joists running parallel to them, supported by cast-iron posts.

The assumptions of the adaptation into lofts called for, above all, changes to the inside of the building. Flats measuring from 60 to 150 m² were designed. For this purpose, additional transverse walls were built for this purpose. The brick elevation remained. The addition containing the stairwell and lift was changed. Here, the architect made use of modern-day tendencies connected with modern technologies and finishing materials. The projection containing the new lift and stairwell was made from a steel structure, with a covering from the reflective glass. The modern solutions were incorporated into the brick architecture of the historic building.

3. Technical problems arising from the of the assumptions of the adaptation

Based on the carried out diagnostic studies [11], conclusions regarding the technical possibilities of adapting the building were made.

The walls of the building are made of solid brick on the cement-lime mortar. On the outside, the elevations are of non-plastered brick, making use of brick in the form of architectural details (figures 3, 4); on the inside, they are plastered. The thickness of the outside walls at the level of the ground floor is 65 cm (2½ bricks). On the remaining stories, this is 52 cm (2 bricks). Anchors are visible on the elevations, signifying that there was a need to reinforce the structure of the walls in the earlier years. The technical conditions of the outside walls varied. On the first story of the main part of the building, as well as the two stories of the tower, the brick was more corroded than on the higher levels. The lower parts of the elevations required missing areas to be filled in and renovation; in the higher parts – this was limited to cleaning and conservation. On the walls on the inside of the building, on the higher stories, water runs and staining of the plasters caused by the leaking roof were observable.

Figure 3. Lessens, mouldings and bands on the brick elevations
The assumptions of the adaptation called for maintaining as much of the original form and historic substance as possible. The brick elevation remained in an unchanged form, whereas the rest was subjected to renovation. The doors and windows were replaced with new ones, staying true to the original form and shape.

![The brick elevations](image)

Figure 4. The brick elevations

Inside the building, two rows of cast iron posts made up the three bay structure, which supported the steel binding joists (figure 5). The diameters, wall thickness and heights of the cast iron posts vary between the individual stories. The diameter of the posts near the base, on the ground floor, was 27 cm. On higher levels, this was 22 cm, 18.5 cm, and 14.5 cm respectively, which a wall thickness of 2 cm. The pole shafts in the lower part are additionally strengthened with ribs. The posts are topped with caps, which support steel binding joists made of 213000 with an axial spread of 350 mm.
The ceiling covering the ground floor in the 70s of the 20th century was completely changed, replacing the former wooden ceiling. Currently, the structure of this ceiling made up of I260 and I220 steel sections which support the prefabricated reinforced concrete slabs (6 cm thickness, 30 cm width; figure 6).

Figure 6. Uncovering of the ceiling over the ground floor. Grate from steel sections which support the prefabricated reinforced concrete slabs
The ceilings of the remaining stories are wooden, with beams of 18 x 23 cm cross-sections, every 90 cm. During the course of the reconstruction in the 70s of the 20th century, an additional monolithic reinforced concrete slab 6 cm in thickness was prepared. The reinforced slab is connected with the wooden ceiling by steel bars anchored in the slab and driven into the ceiling beams. The wooden ceiling beams were reinforced with boards 5 cm in thickness. The ceiling does not reveal excessive deflections, and deformations and cracking were not observed. Foundation uncovering was carried out. The posts situated were placed on a brick pad footing, 2.1 m below the level of the floor.

The roof is pitched and was also rebuilt in the 70s of the 29th century. The previous wooden roof framework was changed into a system of steel beams, which were covered by steel. The roof over the tower is formed by two sloping roofs, with the same height; they are wooden and covered with roofing felt.

In their adaptation into lofts, the outside walls of the north part of the building, an addition from the 70s of the 20th century, were replaced by a new glass facade. The reinforced concrete stairwell situated in this part of the building remained unchanged. The stair flight is on a binding joist from 2 steel I 260 sections filled with concrete, lying on posts from 2 I 300 with connectors from steel sheets; the inside of the steel post structure is filled with concrete. The construction of the stairwell did not reveal deflections, cracking, scratches and distortions.

The carried out calculations revealed sufficient load-carrying capacity of structural elements for the new use as a residential building. The cast iron posed was protected with fireproof insulation and are currently exposed in the flats.

4. Conclusions
The lofts became an attractive offer on the real estate market. The renovation of the post-factory POLON building sparked similar undertakings in other building on Fabryczna St. in Zielona Góra [12]. The adaptation of post-industrial buildings into modern residential ones improves the image and aesthetics of urban space, fully respecting the material components of cultural heritage.

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