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Professional paper

Technical Problems of Industrial Buildings Adaptation - Case Study: "Artist's Alley" in Zielona Góra

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Abstract: The adaptation of post-industrial building allows for solving problems connected with the protection of relics and is useful in the process of providing order to the cultural landscape. However, the adaptation of historic buildings is associated with many problems. At the same time, the conservation, architectural, construction, technological requirements and the investor's ideas must be met. Meeting all conditions at the same time is a difficult task, but possible. The change in the way that a historic building is used requires a series of preliminary studies of the building to be carried out. The article presents the results of the diagnosis of the technical conditions preceding the adaption of a former factory in Zielona Góra.

Keywords: adaptation; adaptive reuse; historic buildings; the protection of cultural heritage; the Venice Charter

1 INTRODUCTION

In the modern-day world, the protection of cultural heritage is connected with the needs of the civilization. Adaptations of historic buildings are made to modern needs. The historic buildings are in use today [1]. The modernization and adaptation of historical objects is the result of ever-changing human needs [2]. Adaptations of historic buildings are the subject of many scientific studies. For example in [3] was evaluates the compatibility of the adaptive reuse of heritage buildings in Egypt. In paper [4] proposing a multicriteria decision aiding approach for ranking adaptive reuse strategies of cultural heritage. The paper [4] focuses on the potential reuse of nine different abandoned buildings located in an industrial valley in the North-West of Italy, with a strong presence of wool and silk factories starting from the 18th century. An overview of the various problems is provided in the conference materials [5]. There are many problems associated with the adaptation of historic buildings. There is a conflict of interest between preserving heritage values and progressing on a sustainable urban project [6].

Dynamic changes taking place around the world and technological advancement are completing the guidelines of the Venice Charter [7]. 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 [8]. A following rule regarding the clarity and distinctiveness of the insertions also allows for contemporary additions. Adapting post-industrial objects in residential areas for modern-day uses has become something of a trend [9]. The beauty of a historical building, however, has made it so that the changes carried out in the object are small [10]. The introduced novelties are essentially fitted into the existing architecture [11]. The needs of civilizational development as well as spatial changes [12] of cities have made for a trend of adapting post-industrial buildings to serve modern-day service needs [13]. 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 [14].

2 ADAPTATION HISTORIC BUILDINGS - COMBINING PROBLEMS

The topic of adaptation of historic buildings is connected with many problems. At the same time, the following requirements must be met: conservation, architectural, structural, technological and investor's suggestions. Meeting all conditions at the same time is a difficult task, but possible. First of all, the guidelines of the Venetian Charter must be preserved. Historical objects are a reminder of the past and care must be taken to preserve them for future generations. The rescue of unused historical buildings is to adapt them to modern purposes. Today's post-industrial buildings cannot fulfil their original functions mainly due to their small cubic capacity for modern industrial technologies. Moreover, with the development of the cities, these buildings have remained located in the middle of the city, and modern industrial halls with machines compatible with technological progress are located on the outskirts of cities. The best solution for preserving historic post-industrial buildings is to change the way they are used. Very often in post-industrial buildings today flats, shopping malls or cultural purposes are built.

According to the guidelines of the Venetian Charter [2], further use of a historic building can be changed for socially useful purposes. However, it must not entail changes in the layout and decoration of the building. Architectural details, painting and sculptural elements are part of the monument and cannot be separated from it. New utility functions must be such that they do not destroy history. All architectural designs and construction works must be based on respect for the original substance. However, the Venetian Charter is not so strict. It allows modern architectural, structural and technological solutions in exceptional situations, but only

when they are necessary. However, new solutions must differ from the original in order not to falsify history.

3 CASE STUDY - "ARTIST'S ALLEY" IN ZIELONA GÓRA. DESCRIPTION OF BUILDING

The building at Fabryczna 13 B comprises three interconnected parts. The first segment, facing Fabryczna Street, contains 2-storeys and a basement; this section is in use and not subjected to adaptation (Figs. 1 and 2). The second part is a one-storey building with a basement (Figs. 3 and 4). The third part is a single-storey extension.

Figure 1 Elevation facing Fabryczna St. (first section) prior to adaption

Figure 2 Elevation facing Fabryczna St. (first section) after adaption

The entire building is a mirror image of the building located on Fabrycza 13 A. Between these neighbouring buildings is an inside square, which can be entered from Fabryczna street through a ornamental gate and two pedestrian gates.

The building was constructed in 1870 in place of wine gardens belonging to the trader Theodor Tobias, and, at the time, belonged to the Lower Silesian Financial Association - the former bank of the Forster family. At first, it was not a classical warehouse, but rather a storehouse of semi-finished products being transported to the Forsters' factories. The main factory owned by the Forsters' was located on what is today Wrocławska Street, and the warehouse also serviced three cooperating companies on Fabryczna St. However, in 1873, the financial group went bankrupt and the warehouse was taken over by the banker Boas Laskau. In 1905, Carl Eichmann opened a weaving mill in the former Forster building. Beginning in 1928, the building functioned as the warehouse of a German Consumer Cooperative from Żagań. After the war, the agricultural and retail cooperative stored vegetables and fruit there. Over the following years, the buildings served as a warehouse for the Społem Cooperative. In 1998, the building suffered a fire, during which the ceiling over the ground floor and fragments of the roof burnt down, while the remaining construction elements were covered with soot. The old un-plastered factory walls gave the place an incredible atmosphere [15].

Figure 3 Southeast elevation of building (second part) prior to adaption

Figure 4 Southeast elevation of building (second part) after adaption

The main building (first and second part), is a two-storey masonry brick structure situated at the end of the street, with a full basement and usable attic. The ceilings over the basement and ground floor are of a timber structure, supported by two rows of brick columns at the level of the basements, and wooden columns at the ground floor level. The roof structure comprises a timber queen post truss, which forms a gable roof covered with bituminous paper laid on roof boarding. The front elevation of the building is highlighted by an axial projection (avant-corps) with a step-like peak. Above the window openings are arched and flat brick lintels, as well as lintels made of steel profiles which were added later. The facade of the building is segmented with pilasters and covered in plaster. The timber window

frames are of the double casement type. In the period before the war, a single-storey hall was added on to the western part (third part). The building is of masonry brick construction, covered by a flat roof supported by two rows of reinforced concrete columns. The windows are of wooden box-type with lintels made of steel sections.

4 MAIN ASSUMPTIONS OF THE ADAPTATION

The basements (in the second part) are planned to be adapted into a winery with a supply base. A tasting room for 60 people has also been designed, along with a preparation (changing) room, cloakroom, warehouses and sanitary facilities. On the ground floor (second part), there will be a cabaret hall capable of holding 80 people, a warehouse, sanitary facilities and a set out office section [16] (Fig. 5). The first floor (second part) is planned to be adapted into artistic workshops. In the single-storey extension (third part), a dance school has been designed - a dance hall for 30 people, changing rooms along with a sanitary facilities, an office and toilets [16] (Fig. 5).

The investment covers carrying out renovation works connected with exchanging a fragment of the wooden ceiling to one that fulfills fire safety requirements, some of the elements of the roof truss structure, the complete replacement of doors and windows, the roof cover, all installations and finishing elements. A new stairwell, a different layout of partition walls and outside stairs have also been designed.

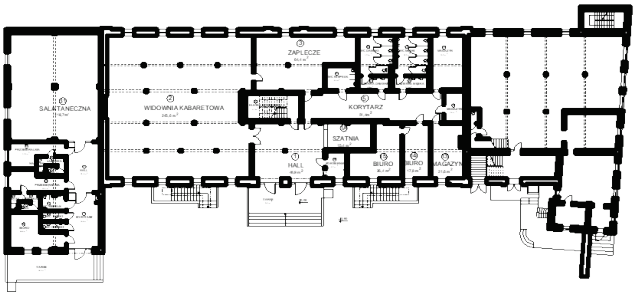

Figure 5 Floorplan of ground level according to the adaptation project

Table 1 Summary of technical problems and their solutions

Problem technical	Characteristics	Solution	Effect
The foundation footings do not meet the requirements set out by standards (Fig. 6)	The foundations under the outside walls are built as brick continuous strip footing laid in cement-lime mortar, underneath columns as brick foundation footings. The cross-sections of the strip foundation measuring 70 x 40 cm, and of footings 60 x 60 x 40, 90 x 90 x 40 cm	Underpinning was planned for some of the footings, and strengthening for others.	Compliance with standard conditions
Destroyed wooden staircase	Degree of technical wear of stairs 100 %	In accordance with fire safety requirements, an internal reinforced concrete stairwell connecting the ground floor with the upstairs was designed. A new reinforced concrete strip foundation has been designed under this structure.	New staircase
The upstairs walls required repair works involving the replacement and filling in of missing bricks.	The existing walls are made of full fired brick laid in cement-lime mortar, plastered on both sides. The thickness of existing walls at the level of the basement is 75 cm, ground floor - 60 cm, first floor - 45 cm, and 73 cm throughout the entire height of walls in the avant-corps section.	Thermal insulation of external walls was planned, as well as making new window openings in such a way that referred back to the original form of the building; some of them were enlarged, others bricked-up.	Insulation of walls, execution of building façade
The existing partition walls	The existing partition walls were made of insulating board	In an effort to adapt the building to the new function, all partition walls were taken apart.	The new walls in the basement were made of full fired brick measuring 12 cm in thickness laid in cement-lime mortar; on the ground floor and first floor, the partition walls were made of drywall
Cellar interior	Missing brick and mortar	Plaster was removed from the existing outer walls of the basement as well as the brick columns, filling areas of missing brick and mortar.	A new cellar
Damaged wooden ceilings	The basements and ground floor were covered with a bare beam ceiling, and thus the timber structure was protected against decay.	Thermal insulation was also carried out using mineral wool	In the fire protection zone, the wooden ceiling was replaced by a joist ceiling of the teriva.
The existing roof is of a timber, gable structure with a slope of 31%, covered by bituminous paper laid on roof boarding, lacking any thermal insulation.	The queen post roof truss with posts in the knee wall remains unchanged (Fig. 7)	The rafters and angle braces were replaced, while the remaining elements cleaned from dirt and soot.	Thermal insulation of mineral wool, replacement of the roof cover, a vapor barrier and finishing the attic with drywall on metal frame were planned and carried out.

5 TECHNICAL PROBLEMS

There were many technical problems during the adaptation. Some of the building's elements were subject to technical wear and tear and had to be reinforced or replaced with new ones. Besides, there were many other problems, e.g. the anti-smoke regulations required the staircase structure to be changed to reinforced concrete, and it was possible to meet the current requirements of thermal standards after the building was insulated. The technical problems are presented in Tab. 1.

Figure 6 Existing brick foundation footings under some of the posts

Figure 7 Queen post roof truss structure during renovation works

Before assuming works, conclusions regarding the technical possibilities of adapting the building were set out. The technical state of the structural elements of the building was assessed as good and strengthening was not required. The change in the designated use and service function of the building also do not have an influence on a change in the technical condition of the building.

6 DISCUSSION

The biggest problem concerning the adaptation of a post-industrial building for serving cultural purposes were not technical issues but those connected with the new service function. Changing the flat roof, strengthening, underpinning foundations, thermal upgrading - these are all typical tasks during such renovation works. Defining the service function proved to be a challenge, thus introducing new functions and corrections to the appearance of the building so as not to lose its initial post-industrial nature but, at the same time, fulfil the expectations of both the investor as well as the appropriate technical requirements. For this reason, the window axes on the ground floor level were shifted, the formerly bricked-over second entrance was recreated, and the layout of communication links changed.

The work of a building engineer is one of an interdisciplinary nature. As one can see, it sometimes also has to influence a change in the appearance of the building so that it reconciles aspects of form, function, structure and technology.

The adaptation of historic buildings to serving modern-day functions does not hold economic rationale, but it does improve the image and esthetics of urban space while fully respecting material cultural heritage [17]. The revitalization of Fabryczna St. will liven up this part of the city, returning it to its inhabitants [18]. In this way, the building at Fabryczna 13 B, as well as all historical buildings subjected to renovation works, are saved from further devastation and, at the same time, rediscovered once again.

7 CONCLUSION

The revitalization of Fabryczna Street in Zielona Góra has been taking place for the past few years. The process was commenced by the adaptation of one of the past factories of the textile industry located on Fabryczna No. 14. Next, lofts were created in another post-industrial building No. 17. Currently, renovation works connected with adapting building No. 13 B for culinary-recreational functions, which is to be named "Artist's Alley" along with its surroundings, are being carried out. The adaptation of post-industrial building allows for solving problems connected with the protection of relics and is useful in the process of providing order to the cultural landscape.

Notice

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8 REFERENCES

[1] Nowogońska, B. (2016). Proposal for determing the scale of renovation needs of residential buildings. Civil Environmental Engineering Reports, 22, 137-144. https://doi.org/10.1515/ceer-2016-0042

[2] Radziszewska-Zielina, E. & Śladowski, G. (2017). Proposal of the Use of a Fuzzy Stochastic Network for the Preliminary Evaluation of the Feasibility of the Process of the Adaptation of a Historical Building to a Particular Form of Use, WMCAUS IOP Conf. Series: Materials Science and Engineering 245 072029, 2017. https://doi.org/10.1088/1757-899X/245/7/072029

[3] Elsorady, D. A. (2014). Assessment of the compatibility of new uses for heritage buildings: The example of Alexandria National Museum, Alexandria, Egypt. *Journal of Cultural Heritage, 15*(5), 511-521. https://doi.org/10.1016/j.culher.2013.10.011
[4] Bottero, M., D'Alpaos, C., & Oppio, A. (2019). Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach. *Sustainability, 11*(3), 785. https://doi.org/10.3390/su11030785
[5] Brebbia, C. A. (2011). *Structural Studies, Repairs and Maintenance of Heritage Architecture XII*, WIT Press.
[6] Bullen, P. A. & Love, P. E. D. (2011). Adaptive reuse of heritage buildings. *Structural Survey, 29*(5), 411-421. https://doi.org/10.1108/02630801111182439
[7] The Venice Charter: International Charter for the Conservation and Restoration of Monuments and Sites (1964), International Council on Monuments and Sites (ICOMOS), *Second International Congress of Architects and Technicians of Historic Buildings*, Venice 1964.
[8] Wong, L. (2016). *Adaptive Reuse: Extending the Lives of Buildings*. Birkhäuser Basel. https://doi.org/10.1515/9783038213130
[9] Kafel, K., Leśniak, A., & Zima, K. (2019). Multicriteria comparative analysis of pillars strengthening of the historic building. *Open Engineering* Vol. 9, Issue 1, pp. 18–25. https://doi.org/10.1515/eng-2019-0003
[10] Drozd, W. & Kowalik, M. (2020). Comparison of technical condition of multi-family residential buildings of various ages. Archives of Civil Engineering, 66(1), 55-67.
[11] Nowogońska, B. & Korentz, J. (2020). Value of Technical Wear and Costs of Restoring Performance Characteristics to Residential Buildings. *Buildings, 10*(1), 9. https://doi.org/10.3390/buildings10010009
[12] Sztubecka, M., Skiba, M., Mrówczyńska, M., & Bazan-Krzywoszańska, A. (2020). An Innovative Decision Support System to Improve the Energy Efficiency of Buildings in Urban Areas. *Remote Sensing, 12*(2), 259. https://doi.org/10.3390/rs12020259
[13] Nowogońska, B. (2019). Preventive Services of Residential Buildings According to the Pareto Principle. *IOP Conf. Series: Materials Science and Engineering* 471, 112034, IOP Publishing. https://doi.org/10.1088/1757-899X/471/11/112034
[14] Radziszewska-Zielina, E., Kania, E., & Śladowski, G. (2018). Problems of the Selection of Construction Technology for Structures of Urban Aglomerations. *Archives of Civil Engineering, 64*(1), 55-71. https://doi.org/10.2478/ace-2018-0004
[15] Bujkiewicz, Z. (2003). *Material and social landscape of Zielona Góra from XVIII to the-XX century*, PTH Zielona Góra [in Polish]
[16] Kochański, P., Nowogońska, B., & Eckert, W. (2018). *Artists's alley Building project Zielona Góra* [in Polsh].
[17] Nowogońska, B. (2019). Performance characteristics of buildings in the assessment of revitalization needs. *Civil and Environmental Engineering Reports, 29*(1), 119-127. https://doi.org/10.2478/ceer-2019-0009
[18] Kononowicz. W. & Sukienniczak, J. (2016). Revalorization problems of the down-town areas on the example of Zielona Góra. *Civil and Environmental Engineering Reports, 23*(4), 9-88. https://doi.org/10.1515/ceer-2016-0053

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