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Revitalization of Historical Building in Wrocław's City Centre, Poland

BERKOWSKI Piotr[1, a], DMOCHOWSKI Grzegorz[2, b], MINCH Maciej Yan[3, c] and SZOŁOMICKI Jerzy[4, d]

[1,2,3,4] Building Engineering Institute,Wrocław University of Technology, Wrocław, Poland

[a]piotr.berkowski@pwr.wroc.pl, [b]grzegorz.dmochowski@pwr.wroc.pl, [c]maciej.minch@pwr.wroc.pl, [d]jerzy.szolomicki@pwr.wroc.pl

Abstract Some aspects of the revitalization of the 14th century historical building are presented in the paper. The building was originally used as a poorhouse and a hospital for children. The original Gothic masonry building on the site was a two-storey building with a cellar, situated in a corner of two streets. In the middle of the 19th century the building was converted into a school and then the first large-scale demolition of the hospital's Gothic walls took place. After the 2nd World War a school was also situated in the building, where it existed until the late nineties. The aim of the renovation process was to convert it into an exclusive office block. The design works were preceded by historical research and on-site investigations. Complex conversion of the object consisted in the reconstruction of the old building structure, creating the inner courtyard and covering it with a glass roof. In the existing part of the basement one of the longest single-nave vaults in Poland and the exquisite roof truss system with a lying bidding-rafter post deserved special attention during the renovation.

Keywords: Historical building, revitalization, architectural and structural aspect.

Building's Historical Background

The building, which has been undergoing a process of revitalization, is located in the central part of Wrocław (Fig. 1). According to the analysis of written sources it was built in 1411 as a poorhouse-hospital for children. It was founded by an unknown citizen of Wroclaw. In the building there was the chapel of the Holy John of Jerusalem. The basis for hospital maintenance was formed by the city burghers contributions, who also took care and supervised it. This orphanage-hospital was one of the first such projects in this part of Europe. Building a hospital, specializing in care for poor children, was possible under the influence of the most modern of the time solutions existed in Italy.

Figure 1: General view of buildings front façade before reconstruction

Inhabitants of the shelter, until about the mid fifties of the 15th century, were also adult persons, who could stay there for life in exchange for their transferred assets. In the apogee of the development

of the facility, at the beginning of the 16th century, there were 112 residents, the most out of all the 11 hospitals in Wroclaw. From the year 1466 comes the only known legacy of work in this house. The building was erected in stages. The first masonry building, the Gothic one, was the corner building, with two floors and a basement. It probably originally belonged to the burgher, who then directed it for the organized poorhouse. Other parts were later added to the corner building on the plan of an elongated rectangle, creating two interconnecting wings. Changes in the hospital buildings were also carried out in the 16th and 17th centuries. They consisted of creating an additional wing, closing all the buildings in the complex with an interior courtyard. The first large-scale demolition of the Gothic walls of the hospital occurred in the mid 19th century, during its conversion to a school. In all of the wings a second floor was added, and openings were made in the walls for new doorways and windows (Fig. 2, Fig. 3).

Figure 2: Part of building back façade before reconstruction

Figure 3: View of part of building's back façade from inner yard before reconstruction

During the 2nd World War the south wing and part of the east wing were destroyed the most. These wings were then demolished which left the building in the shape of the letter C. The school was located there until the late nineties of the 20th century. During the reconstruction of the building, completed in that time, the layout of the building was reorganized, all floors were changed to masonry ones of Klein type, and new stairs made from reinforced concrete were built in the eastern part of the building. Since the liquidation of the school, for a period of more than 10 years, the building remained unused, suffering substantial destruction. The aim of the project was the repair, reconstruction and development of the facility to adapt it for an exclusive office building.

Building's Structure and Technical Condition

At the beginning of the reconstruction process the building had 4 floors above ground (ground floor, 2 higher floors and an attic) and a basement (Fig. 4).The height of each floor is as follows: cellar -3.20 m, ground floor 3.30 m, first floor 3.20 m, second floor 3.50 m, and attic about 4 m below the ridge. The building construction is traditional, with the so-called longitudinal layout of bearing walls. Load-bearing walls are made of full brick, with a thickness from 90 cm in the basement to 65 cm on the second floor. Headers are made of flat or arched bricks. Some serious cracks were seen in the external walls. Interior wall thickness ranges from 90 cm in the basement to 27 cm in the attic. The walls of the cellars and the ground floor were heavily saturated with moisture. Measurements showed the level of moisture in the basement walls around 10-12%, and on the ground floor at least 8-10%, while the limit is 4%. Humidity of the walls above the ground floor were about 2-3%. Basement dampness occurred due to the lack of horizontal insulation of walls and lack of ventilation. The floor over the basement is in the form of brick vaults, based on the load-bearing masonry walls. It is an original vault, dating back from the 14th century (Fig. 5). Over one of the basement rooms there is a vault with a length of 22 m and a span of about 6 meters, which is one of the longest one-bay-vaults in Poland.

Figure 4: Building back façades during reconstruction works

Figure 5: View of masonry vault over basement after removing floor layers

The vaults were filled with slag and wooden or cement floors were laid on them. Moisture and surface corrosion of the mortar in the joints between bricks were found. There were no cracks or other significant damage detected in these elements. The higher floors were rebuilt of massive Klein type on steel beams, with slag filling and wooden floors.

The roof rafter-framing is wooden, generally two-slanted and covered with ceramic tiles. It has different rafter layouts (Fig. 6). On one part of the roof a truss system of unique solution was made with lying bidding-rafter posts (Fig. 7). Some of the main roof trusses were not fixed to the steel ceiling beams and then large horizontal forces were directly transmitted onto wooden foundation beams and then on the brick attic wall. This resulted in visible deformation of the walls in these places. Some of the wooden elements of the roof structure suffered superficial destruction by biological corrosion despite them being made of larch, and having longitudinal cracks. The truss structural elements, however, showed no excessive deflections or displacements.

Revitalization Works

The architectural design and constructional works were preceded by detailed archaeological and material research. The walls and floors were examined in order to determine the stratigraphy of the walls, plasters and paint coatings, as well as determining the form and structure of the former interior finishing. The study allowed the formulation of conservation proposals, preceded by a general look at the spatial development of the hospital building during time.

Figure 6: View of wooden rafter framing before repair

Figure 7: Laying wooden rafter framing during renovation

A geotechnical survey, foundation excavations, and static-strength calculations were also carried out. No damage was found in the foundations, however the calculations showed that the loads were twice as high as the capacity of the ground. The conclusions of these works were taken into account when designing the reconstruction of the building, consisting of the rebuilding of demolished parts of the building, and the inner court, with dimensions of ca. 20x30 m with a new glass roof.

According to the geotechnical studies the soil surface is made up of anthropogenic grounds. Below them, from a depth of approximately 4.00 m, there are Holocene formations: sands with a concentration degree of $I_D = 0.68$. Ground water was found at about 7.00 m below ground level. The designed level of the building's new garage floor (3.18 m below the ground level) was above the groundwater level, however, the level of the new foundation was about 30 cm above the existing building foundation. The foundation of the new building was designed as a slab with a thickness of 65 cm. The excavation was protected from the street and the courtyard with a sheet pile wall made of micropiles. Within the courtyard, the walls of the existing building were protected by using singularly anchored retaining walls also constructed from micropiles. The building's historic brick foundations were left unchanged, except for parts of the walls, including the gable wall, where they were planned to be underpinned.

In the case of the historic part of the building the cellars masonry vaults were assumed to be left as well as Klein slabs over higher floors. Finishing layers and slag filling were removed from the existing floors. Vaults were cleaned and mortar loss in joints were filled using new lime mortar.

Figure 8: View of new steel roof structure supported on old building's wall and RC pillars

The new filling was made of keramsite, and then concrete coating and floor layers were made. Finishing layers and slag filling were removed from the Klein floors. The slabs were cleaned (Fig. 8), joints between bricks were filled with new mortar, and a bearing concrete plate was made and laid on foamed polystyrene insulation. The plate was based on the existing steel beams, which were covered with concrete. In the new building all the basement walls were designed as reinforced concrete ones. The new floors were designed as monolithic, cross-reinforced concrete continuous slabs. Between the courtyard slab and the office building a 2 cm dilation was designed. The flat roof of the new building was designed as the "green roof", with rainwater recovery and a retention tank in the garage.

The main load-bearing element of the courtyard glass roof was designed as a system of arched steel girders and flat beams (Fig. 9). At one end these arcs are based on curved reinforced concrete columns, referring to the line of arcs coming out from the basement. However, a significant part of the roof had to be based on the walls and pillars of the old building. It was an important problem because of the large horizontal and vertical forces generated by the roof. In this case it was decided to strengthen the masonry pillars of the old building by using steel casing and support roof girders on masonry walls using special sliding posts that do not transfer horizontal forces. The horizontal parts of the roof were based on spatial trusses and beams made of rectangular tubes (Fig. 10).

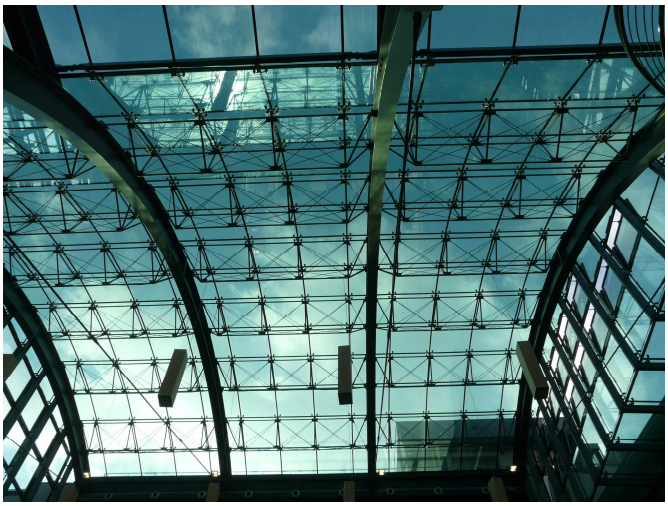

Figure 9: New steel roof over building's courtyard

Figure 10: Old building after renovation

Final Remarks

The authors of the paper were involved in all parts of the described historic building restoration process combined with its development and adaptation to current constructional requirements, id. in the expertise of its technical state, structural design and supervision of the building work process. The fundamental problem in conducting such work is to adapt an existing building layout and construction to the planned future function of the building. All the work should be preceded by conservation and archaeological research to determine the acceptable range of changes and to emphasize and preserve the most important and most valuable parts of the reconstructed building. In the building the vaults of the basement, the wooden rafter framing, and the fragments of stone portals of the existing walls were under consideration. The spatial layout of the whole historic building was also recovered by the fitting of the new building's walls to their original location. An interesting solution was the execution of the glass roof over the courtyard - one of the largest in Wrocław.