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RENOVATION OF BUILDINGS AND MODERNIZATION OF BUILT-UP AREAS – A CASE STUDY

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K e y w o r d s: civil engineering, renovation of buildings, modernization of a built-up area, engineering problems.

A b s t r a c t

The paper contains a description of three examples of the renovation of buildings and modernization of the surrounding area. The ownership rights of each premises were undisputable and the buildings were not registered as having special architectural or historic value. Nevertheless, it proved to be a complex and difficult task to undertake a decision concerning the extent and form of the revitalisation. In each case, the renovation works were preceded by a careful analysis of broad-scope profitability, which enabled the investor to minimize the risk involved.

WYBRANE PRZYKŁADY RENOWACJI BUDYNKÓW I MODERNIZACJI OBSZARÓW ZABUDOWANYCH

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S ł o w a k l u c z o w e: budownictwo, renowacja budynków, modernizacja obszaru zabudowanego, problemy inżynierskie.

A b s t r a k t

W artykule zaprezentowano trzy przedsięwzięcia z zakresu renowacji budynków i modernizacji towarzyszących im terenów. W każdym z analizowanych przypadków były uregulowane kwestie własności nieruchomości, tereny oraz budynki nie podlegały ochronie konserwatorskiej, mimo to podjęcie decyzji co do zakresu i formy rewitalizacji okazało się zadaniem złożonym i trudnym. Każde zadanie poprzedzono staranną analizą szeroko pojętej opłacalności, która pozwoliła zminimalizować ryzyko.

Introduction

Part of good development of urban areas involves projects aiming at renovation of dilapidated buildings and modernization of built-up areas. Such projects are undertaken in order to improve the spatial management and enhance the value of buildings in terms of their technical condition, aesthetics quality, functions and standards of use (BILIŃSKI 2003).

Very frequently renovation is more difficult than constructing new buildings as it has to take into consideration several aspects, such as the present condition of a building or the land parcel it stands on, the limitations caused by the original design, recommendations of the Building Conservation Officer[1], economic considerations, whether or not it is possible to stop using the building during the renovation works, how burdensome the works will be to the nearest neighbours, etc.

The paper presents three cases of renovation works carried out on three buildings alongside modernization of their immediate surroundings[2]. The three cases involved the buildings and land used for different purposes, but none of the objects was a registered building. In each case, there was a different reason for undertaking the renovation works and making the decision about the extent of the improvements to the existing facilities.

The objective of this article has been to demonstrate that an optimum decision concerning modernization of old buildings needs to be preceded by a comprehensive analysis based on the guidelines of the revitalization programme for a whole town or a given area, inventory and evaluation of the initial state of the premises, expert technical opinion, a concept for repairs solutions as well as a preliminary costs analysis.

Modernization of the premises owned by the Institute of Animal Reproduction and Food Studies of the Polish Academy of Sciences

The first effort to modernize the buildings owned by Olsztyn-based Institute of Animal Reproduction and Food Studies, the Polish Academy of Sciences (PAN) was made in 2001.

At that time the Institute was seated in Bydgoska Street, in a building raised in the 1970s using traditional building technologies. It was a single-

[1] This applies only to registered buildings and land plots.

[2] The renovation projects of the buildings and built-up areas were prepared in Olsztyn-based architectural office ARCHE owned by Maciej Deja and Barbara Deja.

module, two-storey building with a basement and a ventilated flat roof (Fig. 1). The technical state of the building was satisfactory, but the building was too small for the institute, which was growing in size, and it failed to meet the standards regarding facilities and aesthetic values. What was necessary then was to renovate and expand the building.

Fig. 1. The building of the Institute of Animal Reproduction and Food Studies, the Polish Academy of Sciences (PAN) in Olsztyn, the north-eastern angle, as of 2002. Photo: B. DEJA

Fig. 2. The building of the Institute of Animal Reproduction and Food Studies, the Polish Academy of Sciences (PAN) in Olsztyn after the renovation and expansion. A view from the south-eastern angle. Photo: B. DEJA, 2008

The plans to modernize the complex of the PAN buildings (there are two other buildings on the grounds designated to be renovated: an animal house and a hotel, both in a similar technical state as the main building) complied with the urban revitalization programme.

"The Site Development Conditions" issued for the property in Bydgoska Street restricted the vertical expansion of the two-storey building to one additional floor, which would be a usable attic under a gable roof. Thus, it was necessary to analyse a possibility to expand the building horizontally.

The developed parcel, partly overgrown with trees, touched Bydgoska Street to the south and a compound of gardens to the west. It had a large westerly slope and very few spaces available for construction (Fig. 3).

By necessity, the expansion of the Institute's main building concentrated along the south-western axis (also because it was necessary to preserve unobstructed front walls with windows in the existing building), while maintaining the required distance of 4 meters to the adjacent land plot.

Another essential aspect was to reduce to the necessary minimum any interference with the growing trees and plants (in the end, it was possible to save all the trees).

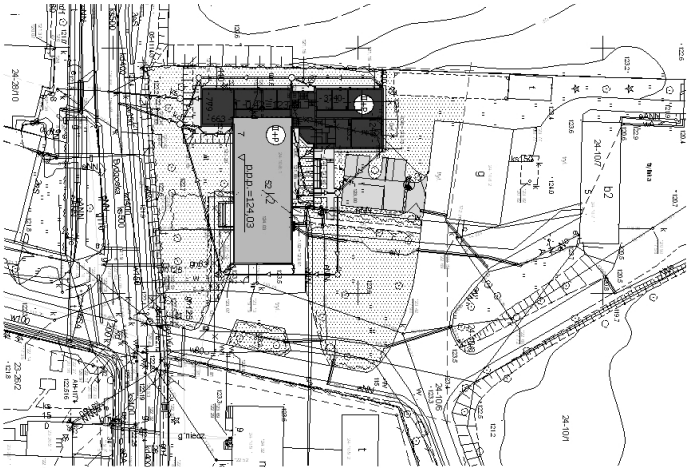

Fig. 3. The development plan for the land plot in Bydgoska Street. Designation: (II+p) – the expanded building of the Institute, (g) – the animal house, (b2) – the hotel building. Drawing: M. DEJA

The refurbished main building was designed as a three-storey building with a cellar and usable attic, built on an L-shaped plan (Fig. 4).

The interconnecting passages between the old and the new module of the building were designed on the ground floor and in the attic. In the newly added attic, the passage was included in the architectural design whereas in the existing ground floor it was made by changing one of the windows (seen in figure 4 in the top right-hand corner of the old building drawing) into a door.

The former entrance facing busy Bydgoska Street was abandoned. Instead, the main entrance was placed in the north wall, which made the building easily accessible from the car park (Fig. 5).

Common space was designed in the new module of the building, right behind the main door. It consisted of a lobby, a staircase and a lift, a cloakroom, a reception and a large staff room behind a glass-filled curtain wall. A similarly planned common space can be found on each floor, where it leads to the laboratories, office rooms and workrooms.

The expansion of the building was carried out using the traditional construction technology and locally available building materials. The old building was covered with a gable purlin-rafter roof supported on bearing walls (Fig. 6). A similar roof (also tiled with Dutch roof tiles) was made on the new building. The roof was supported by lengthwise bearing walls and binding joists, which along with the supporting posts constitute a load bearing structure for the floors in the part of the new module adjacent to the side wall of the old building (Fig. 4).

Fig. 4. The plan of the ground floor of the Institute of Animal Reproduction and Food Studies PAN in Olsztyn. Drawing: B. DEJA

Fig. 5. A view of the new building of the PAN Institute in Bydgoska Street, the north-eastern side. Photo: B. DEJA, 2008

The bearing walls of the new module were constructed from calcium-silicate brick and the foundation walls were made from C 12/15 class concrete. The aluminium-glass wall of the staff room was designed using Reynaers CW 50 2.1 panel walls system, according to DIN 4108 (Fig. 5). The joists, posts, ring beam and staircases were designed as monolithic concrete structures using C 16/20 class concrete reinforced with A-III class steel bars. Due to certain assembly limitations inside the old building, Leier Plus rib and slab floors were used.

Prior to designing the foundations of the new building, the foundations of the existing building were unearthed to determine their size and depth.

It was assumed that the expansion building would stand on footings and foundation walls made from C 16/20 class concrete reinforced with A-III class steel bars. Because of a high level of ground water (0.50 m below the footings), it was recommended to make the foundations using concrete mixed with Hydrobet and to carry out geotechnical monitoring while digging the foundation trenches.

All the office rooms and bathrooms were fitted with a gravitational ventilation system, whereas the laboratory rooms received mechanical ventilation supply/exhaust ventilation. The ventilation control rooms were placed in the attic.

Special ramps and an outdoor lift for the disabled (also wheelchair users) were added to the building. While planning the whole building project, the works were divided into stages so that the existing building was never put out of use. In January 2008 the construction works were completed and in spring this year the landscaping works will begin, including a new car park, a new

drive and some new plants (Fig. 7). The renovation of the other two buildings[3] – the hotel and the animal house – will commence when the investor secures proper funds.

To the west side, the Institute of the Polish Academy of Sciences neighbours with a compound of gardens, which unfortunately spoil the view, as they contain a rather hectic composition of plants and many small garden sheds (Fig. 7). The value of the redesigned Institute building cannot be fully appreciated as long as this side of Bydgoska Street is not properly modernised.

Fig. 6. A sectional view of the old building in Bydgoska Street. Visible are the existing flat roof and the new gable roof. Drawing: B. DEJA

Fig. 7. A view of the new building of the PAN Institute in Bydgoska Street, the western side. Photo: B. DEJA, 2008

Modernisation of Urania Sports and Convention Centre

Fig. 8. A view of the Urania Sports and Convention Centre from Piłsudskiego Avenue Photo: B. DEJA, 2007

[3] There is a project which covers these renovation works, prepared by ARCHE in Olsztyn.

The Urania Sports and Convention Centre[4] in Olsztyn stands at 44 Piłsudskiego Avenue. It is not a protected building, but certainly is an interesting example of good aesthetic quality, construction solutions and functional values.

The Urania Arena lies in the central part of Olsztyn, on a small hill, near large open spaces and scattered houses, blocks of flats and single-storey shop buildings. It is separated from busy Pisłudskiego Avenue by a broad pavement and a steep slope overgrown with shrubs. There are broad steps and a ramp leading to the building. There is also a large car park in front.

The main arena is covered with a dome supported by 32 prefabricated reinforced concrete pillars joined at the top by a monolithic ring beam (Fig. 9). The 12-meter high supporting pillars are anchored in sleeve foundations, each of which was secured with four Franki piles.

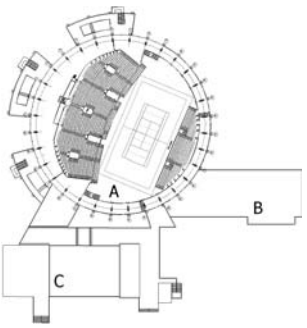

Fig. 9. A plan of the ground floor of the Urania. Drawing: B. DEJA

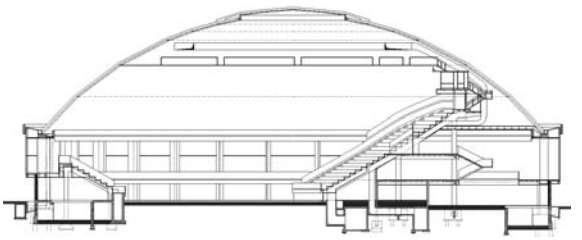

Fig. 10. A sectional view of the Urania main arena Drawing: B. DEJA

The dome is a spheric ribbed structure, whose base diameter is 70.0 m, the rise of arch equals 17.45 m and the radius vector is 45.0 m. The subsequent rings of the dome (consisting of latitudinal bars) are joined with the longitudinal bars (ribs) forming equilateral triangular lacing, where the latitudinal bars are the base of the triangles. All the bars were made from two welded channel bars, which made tightly sealed box-sections (DEJA 2007).

The cap bearing ring (welded with plates anchored in the reinforced concrete ring beam) was made from welded sections of steel sheets.

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[4] The building design for this object was prepared in the Miastoprojekt General Construction Design Office in Olsztyn (architecture – Wiesław Piątkowski, construction – Henryk Żejmo). The arena was opened on 1st September 1978, almost 30 years ago.

The steel construction elements were covered with three layers of suitable paints. The cap bearing ring was lined with prefabricated sandwich boards and, along with the ring beam, covered with galvanized steel sheet scales, fitted to steel flat bars using timber laths.

The cap was covered with aluminium tin sheets fixed to prefabricated sandwich boards insulated with two layers of tar boards (the sandwich boards consisted of bearing ribs made of cold formed sections and pinewood boards hammered to wooden bracing frames).

The insulation of the dome roof was solved by hanging a wire net below the ceiling with rockwool boards, which was then lined with perforated tin panels.

At the topmost part of the cap there is a ring-shaped ventilation gap, which was obtained by rising the roof ends.

The outer walls of the main arena were made in the following fashion: at the ground floor level the whole walls are covered with marble plates; above, there is a ring beam with a gallery (ambulatory) lined with tinned steel sheet scales; from the first floor upwards the whole walls consist of Vitrolite sheets.

In the Vitrolite-made walls there are 24 ornamental elements, called "lunettes" by the designers. They consist of two three-dimensional parts made of welded tin sheets and fitted with windows.

Outside the main building, to the side occupied by the main rostrum and entrance lobbies, there are three emergency exit terraces connected with the first floor hallways by doors and equipped with steps which lead to an open square.

In 2001, the authorities of the Town of Olsztyn (the owner of the building) opened a competition for renovation of the Urania and modernization of the surrounding grounds.

For the purpose of this competition, the technical state of the building and the landscaping condition of the grounds were evaluated. The most important conclusions in this evaluation pertained to module A of the building no signs of poor technical condition of the bearing construction, including the pillars and reinforced concrete ring beams or the steel construction of the dome were observed.

However, other construction elements of the building showed many flaws:

– the Vitrolite wall was not weather proof, letting rain, wind and cold air through leaky seals made with a sealing mass called Olkit, which shrank and crumbled in winter while melting and flowing off the seals in summer. The glass panes in the window openings had been cut out carelessly and cracked as they tore against the channel bars in which they were set without any seals. The leaks in the seals were mended on many occasions with silicon or wooden boards, but as a result the surface of the whole wall was patchy and looked ugly;

– some of the coated tin scales which covered the lower and upper ring beams had fallen off as the wooden planks to which they had been attached had decayed and the steel flat bars in the bearing construction had corroded. In addition, the scales had become tarnished and some had bent because of winds;

– the lunettes were badly corroded and could fall off the wall because of the poor condition of their mounting construction (these elements were beyond any repair);

– the outer lining of the dome made of aluminium tin was not waterproof, which was evident during spring thawing, when melting snow leaked inside the building. This leakage was caused by the fact that the outer lining on the roof was sucked off from the sheathing and in some places strong winds would blow up the tin, which was weakly fixed to the decaying planking;

– the plaster on the emergency exit terraces had many holes and traces of repairs;

– the steps from the terraces were completely worn-out and needed major repair;

– the fixtures inside the building were designed in such a way that it was not possible to divide the building into zones and ventilate them separately. It was also impossible to adjust the heating power of the air heaters in particular parts of the building. Due to the faulty construction of the air filter station, which was out of use, the air inside the arena was not purified or humidified. Other flaws of the ventilation system included: the vents from the underground shafts making the air inside the arena cooler; the warm air from the upper levels of the arena not being sucked away, and the immense size of the ventilation control room;

– the heating system had many faults too. The major one was that the cost of heating power delivered by the municipal thermal power station was very high. The heating system failed to generate adequate temperatures inside the building (typically 13-14^{o}C in the winter season). Old and inefficient thermal centres made it impossible to regulate the air temperature inside the building, while the radiators were corroded and filled with slime.

Below there are the main elements of the modernization plan for the Urania Arena. It is worth noticing that the underlying idea was to preserve the original aesthetic quality of the building while using modern materials in the main building it was advised to dismantle the Vitrolite wall, the lining of the upper and lower ring beams and the metal lunettes. A frame made from aluminium sections was to be mounted onto the existing steel bearing construction to support lining walls. The ornamental elements of the facade – the lunettes – should be made of aluminium tin and mounted in front of the facade using construction profiles.

The suggested solution for the outer wall provided the building with the thermal insulation, waterproofness and windtightness compliant with the standards. It also improved the aesthetic values of the building. Using small-sized facade elements guaranteed that the costs would be lower should any of the elements be damaged and needed replacement.

The renovation project included the replacement of the worn-out roof. The solution which was suggested did not require any strengthening of the roof bearing construction as it recommended using light aluminium profiles made by the German company Corus Bausysteme. The suggested insulation of the upper side of the dome would eliminate leakage through the untight suspended rockwool construction inside the dome. It would also facilitate the arrangement of acoustic elements and lining.

The suggested solution for the modernization of the mechanical ventilation system in the Urania relied on a general change in the use of this installation while preserving the existing air distribution system. Therefore, the idea of having a central machinery room was abandoned whereas some of the existing system of concrete channel which distributed fresh and used air as well as some air intakes and outlets would be preserved. The air should be prepared in 4 ventilation central units.

The concept for the modernization of the heating system comprised the following recommendations:

– instead of buying thermal power from the municipal thermal power station, the Urania should have its own power station powered by natural gas and fuel oil,

– there should be four independently controlled thermal zones in the compound, each working at different heating parameters. The zones are: building B, building C, main hall, lobby in hall A,

– convection heating in buildings B and C using panel radiators and thermoregulators,

– the heating of the main arena consisting of 10% convection heating (at present 60%), 50% automatic air heating system using Clima Heat equipment and 40% by mechanical ventilation with complete circulation of air,

– economical heating of the lobby in building A using Clima Heat radiators,

– the whole heating system integrated with the mechanical ventilation system and the thermal energy generation station by a central computer control system of the building compound BMS.

The concept for arranging the interior of the arena, in response to the expectations of the Urania administrator, contained suggestions which would increase the seat capacity and improve the aesthetic quality of the interior.

The exterior infrastructure of the Urania also needed to be modernized, for which purpose the project included such suggestions as: new surface of the

drives made of concrete pavers, setting car park spaces, new lighting of the drives and additional lights to illuminate the building; renovation of the terraces by making new silicon plaster and new exterior finish using coated steel sheets, adding new plants[5].

All these renovation works could be completed rather easily and in stages, using modern technological solutions. The costs of the modernization were evaluated at about 10 million Polish zloty. Building a new sports and convention centre would be several-fold more expensive. Should a decision be made to construct a new compound, the additional costs incurred by the demolition works would be very high, too.

The refurbishment and expansion of the Urania based on the existing construction would not cause such big inconvenience to the environment and the people living nearby as constructing a new centre (transport and traffic around the building site, foundation piling, etc.)

Irrespective of the advantages of the modernization, no decision has been made as of present to give it the green light (mainly because of financial reasons). Recently, an opportunity has occurred to apply for EU funds dedicated to infrastructure revalorization. This has brought back the question of the refurbishment of the Urania when discussing investment projects managed by the Council. However, it has been seven years since 2001, when the compound underwent technical evaluation, so it is now necessary to update the modernization solutions, taking into consideration the current technical state of the building as well as some newer technologies.

Modernization plans to convert a fodder store to an office building of the Centre of Environmental Biotechnology of the University of Warmia and Mazury in Olsztyn

The Faculty of Environmental Protection and Fisheries at the University of Warmia and Mazury in Olsztyn, which in 2002 started research in biotechnology, needed a well equipped building to house rooms for the new laboratories to open, such as technological, chemical analysis, genetic engineering, biochemical, toxicological, low temperatures, microbiological, fermentation, hydrobotanic, reagents preparation, computer, audiovisual processing labs (*The Functional Programme of the Centre*... 2002).

As the Faculty did not have a proper building, it undertook an effort to adapt for this purpose an old fodder storehouse (built in the 1960s), located at the corner of Dybowskiego and Słoneczna Streets, in Kortowo II.

[5] The suggested modernization of the surrounding land could only regard the immediate surroundings of the arena because of the prospective construction of a new road nearby. It is only after the road is built that the renovation of the whole area will be possible.

The building underwent a technical evaluation, which showed that it was in very bad technical state. The unheated building, which had been used to store loose animal fodders, had very moist walls, attacked by fungus. Besides, the height of the ground floor was very low and certain construction limitations excluded a possibility to expand the building vertically, whereas the small size of the land parcel on which the building stood limited its horizontal expansion.

Thus, a cost analysis was carried out to determine the profitability of refurbishment and modernization of the existing building as well as to indicate possible effects of the renovation works. Based on this analysis, a decision was made to demolish the old building and raise a new one – the Centre of Environmental Biotechnology.

After the demolition the whole land plot was available providing enough room to locate two underground tanks. One of them was to collect wastewater, which would be passed to a laboratory equipped with a semi-technological SBR reactor, and that would enable researchers to monitor wastewater treatment for scientific purposes (an additional advantage of this solution was that the municipal sewage system would receive treated wastewater).

The rainwater collected in the other tank was to be used to water the green grounds around the building and flush the toilets.

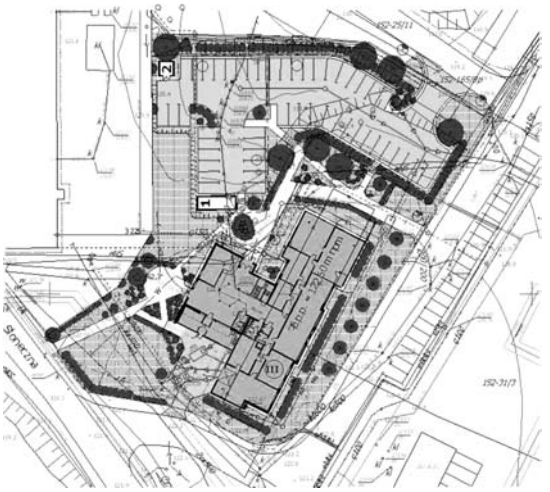

Fig. 11. The development plan for the Centre of Environmental Biotechnology UWM. Designation: III – a three-storey building of the Centre, the thin line shows the outline of the demolished fodder storehouse, 1 – a roofed bicycle stand, 2 – a trash bin. Drawing: M. DEJA

Figure 11 shows the plan for landscaping the grounds around the Centre of Environmental Biotechnology. The modernization of the land plot consisted of setting a comfortable car park with an access drive from Świetlista Street and

designing beautifully kept green areas. Noteworthy is the fact that while landscaping the grounds, not a single tree was cut down. Other objects located on the premises include a roofed bicycle rack and a dustbin hidden behind shrubs.

Fig. 12. The fodder storehouse at 46 Słoneczna Street as of 2001. Photo from the archives of the Real Estate Management Department of the UWM

Fig. 13. A view of the Centre of Environmental Biotechnology from the south-eastern side. In the foreground, the fence, gate and part of the landscaped ground. Photo: B. DEJA, 2008

Figures 12 and 13 show the old fodder storehouse designated to be demolished and the building raised on the recovered land plot. The drastic decision made by the architect (and accepted by the investor) made it possible to raise a functional building, which serves the purposes of the users very well and is liked by the people living nearby. The modernization of the land plot to house the Centre improved the aesthetic quality of this part of the university campus.

The University has more plans to revalorise the grounds near the Centre, which means that the modernization of the Centre is just a step in a broader plan, whose final execution (depending on the acquisition of external funds) will certainly improve the spatial management of Kortowo II.

Summary

The paper presents three cases of the renovation of buildings and modernisation of the grounds around. In each case, the ownership rights were undisputable and the buildings were not registered as having special architectural or historic value. Nonetheless, the decision regarding the extent and form of the revitalization of each building was a difficult one, preceded by a careful analysis of the profitability of the undertaking, which enabled the investors to minimize the risk involved (BILIŃSKI 2007).

Only one of the three cases consisted of the renovation and expansion of an existing building as well as the modernization of the whole premises (the Polish Academy of Sciences Institute in Bydgoska Street).

The owner of the Urania Sports and Convention Centre accepted the revalorization project but did not carry it out due to financial reasons. As the renovation works were postponed, the degradation of the building and its surroundings continues to the present day.

In the last case – modernization and adaptation of a storehouse in Kortowo II (to house the Centre of Environmental Biotechnology) – the expert opinion regarding the technical state of the old building along with the economic analysis of the enterprise showed that the best solution would be to pull down the existing construction, raise a new building and renovate the grounds. These plans have been put to life, thus obtaining a new value – an aesthetically beautiful and functional building located on a well-kept land plot.

Regardless of the difficulties encountered while undertaking renovation of old buildings – preliminary analysis, designing, and executing the project – revitalisation efforts are well- grounded and should be treated as part of the development strategy (BILIŃSKI 2005), especially in towns, where such works improve the value of a real estate being modernized and, whenever the prospects of obtaining new lands to be developed are slim, revitalization is an only chance for urban development.

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