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CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

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RENOVATION AND MODERNISATION OF A POSTINDUSTRIAL FACILITY IN POZNAŃ

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The paper presents a renovation process of a historic postindustrial building situated on premises of Gazownia Poznańska. An unprepared team of designers made a lot of mistakes and negligences, which led to additional work, repairs including. The increased scope of work also led to a substantial increase in the cost of the carried out renovations. The modernisation process was realised with the use of modern technologies, some of which for the first time in Poznan.

Keywords: renovation, modernisation, jet-grounting, helifix, SCC

1. INTRODUCTION

Renovation and modernisation projects of old building substance may well contribute in satisfying urgent social needs by providing new functions [1]. Structures of old industrial buildings, unlike modern manufacture facilities, were made of durable materials. Thus, in terms of basic principles of sustainable development: *"...current use of the heritage resources does not nullify the chance to pass them to future generations ..."*[2], it is possible to fully exploit them while integrating as elements of modern facilities. The example of such reasoning is revitalisation of one of the oldest gas tanks in Europe, which resulted in converting it into service and commercial facilities [3, 4]. Facilities of various use, from office buildings [5] to industrial chimneys [7], are subject to revitalisation. A multifunctional historic building is an interesting example of such adaptation [6]. However, in all these cases, the most important element is the future durability of these objects [8, 9].

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2. DESCRIPTION OF THE MODERNISED BUILDING

Dressing room – Bath (Szatnia–Łaźnia) house, which was subject to adaptation and extension, had been erected at the beginning of 20th century in the style of industrial architecture. With a architectural brick detail, it refers to buildings in the northern part of Gasworks. The property was built probably in the late nineteenth century or early twentieth century, as a four floor traditional structure with a basement (fig. 1, 2). Practically, no technical documentation was found on the basis of which the project could have been realised. Initially, the analysed facility was intended to be a paper products factory for Cohn and Sieburth company, which can be seen on the letterhead with a date 1908 on it (fig. 3). Later, the property became the possession of the gas plant and the building was designed as the Dressing room – Bath facility. The dressing room and bath have remained on the ground floor to this day, on the subsequent floors there is a lounge, various rooms and the archive. In the inter-war period, the cellars were converted into the air-raid shelter and a tunnel was built which connected the Dressing room – Bath building with the building of the Gasworks Directorate.

Fig. 1, 2. Dressing room - Bath house before modernisation, the front and back views

In probably 1973, after 117 years of operation, the Gasworks was extinguish, there was Koppers' boiler building in immediate vicinity of analyzed building. After the war damages, Koppers' boiler building was rebuilt and in the 50s expanded (fig. 4, 5).

On the north side of the dressing room-bath building, there was a wagon discharger where wagons of coal were emptied and then the coal was transported to the boiler room on conveyor belts (fig. 6).

After the demolition of the boiler building, its underground structures were buried, and a one-floor building without a cellar was built on the north side. This situation remained until the modernisation.

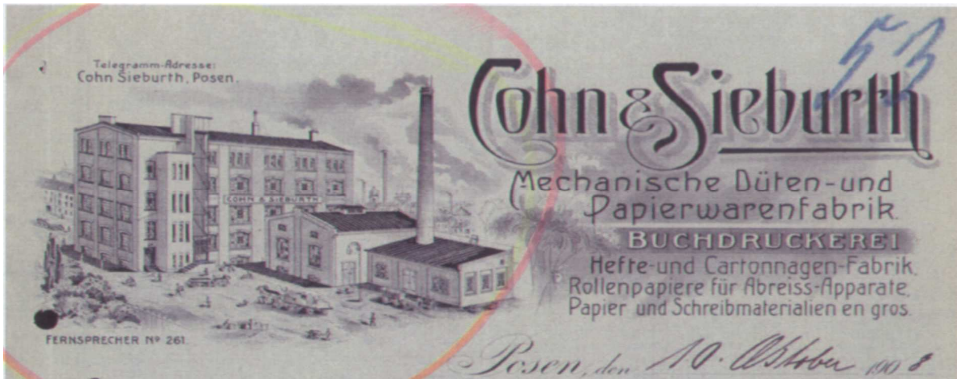

Fig. 3. A view of the dressing room – bath on the company's letterhead, 1908 r.

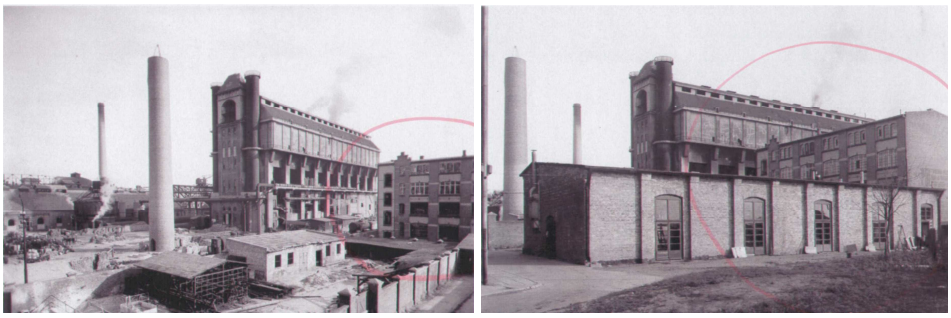

Fig. 4, 5. Koppers' boiler room building, view of 1916 during the construction of the chimney in the 50's

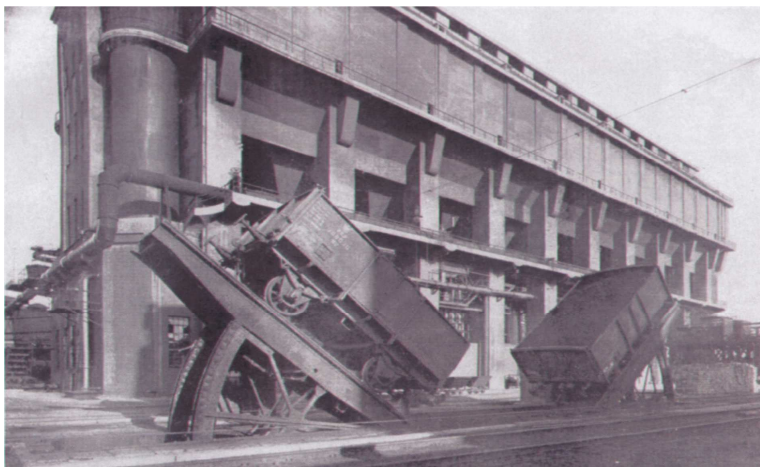

Fig. 6. Wagon discharger, view at the south wall of the the Koppers' boiler room building

3. THE TECHNICAL CONDITION OF THE MODERNISED BUILDING

On the basis of the macroscopic and nondestructive research, the masonry walls were examined. It was found that the walls were built with brick of class 10.0 MPa and lower, on cement-lime mortar of 3.5 MPa (and lower). All the exterior walls were covered with front-face bricks. The walls inside the building were plastered with cement-lime plaster 2-3 cm thick. Floors on all levels were made as ceramic-steel composite ones (fig. 7).

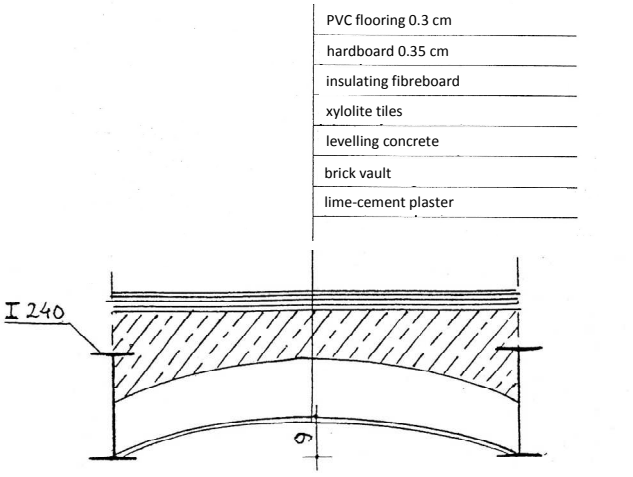

Fig. 7. A cross-section through the existing floor

Floors consist of brick vaults on beams made of I240 steel. The average beam spacing is 0.94 m. The ceramic arch was 12 cm thick, and their bending arrow amounted from 9 to 10 cm. The steel beams are supported on external longitudinal walls of the building and on a steel suspension placed at half-width. The span of the floors is about 9.68 m measured from wall to wall. Beams in both spans are assumed as freely supported. The central joist is produced with two I360. It is supported on indirect columns spaced 4.70m, and rests on the gable walls of the building. The cross section of the steel column is of a circular pipe shape, and consists of four identical profiles connected with rivets (fig. 8). The geometrical characteristics of the sections are taken from [10]. According to the tables presented in the book, profile No. 5 was used on the second floor, profile No. 7 ½ was used on the first floor, and on the ground floor and in the cellar – profile 12 ½. Brick arched and steel lintels were used and produced on the basis of 2 I200, with approximately 15 cm spacing. The wooden gable roof of the building was covered with roofing felt on roof sheating. A longitudinal

structure was applied in the building, i.e. the floors were supported on load bearing exterior walls and also on the internal column-beam system.

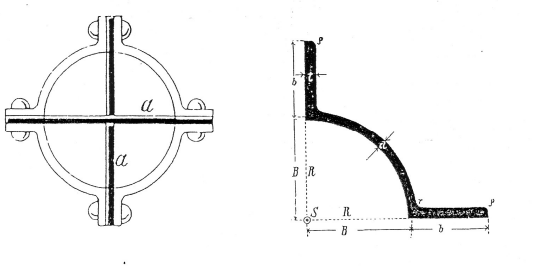

Fig. 8. A cross section of the column supporting the main joist

In order to evaluate the ground-water conditions in the zone of the analysed building, all necessary geotechnical tests were carried out. On the basis of the site- and laboratory tests as well as the necessary analyses, a geotechnical cross-section elaborated (fig. 9).

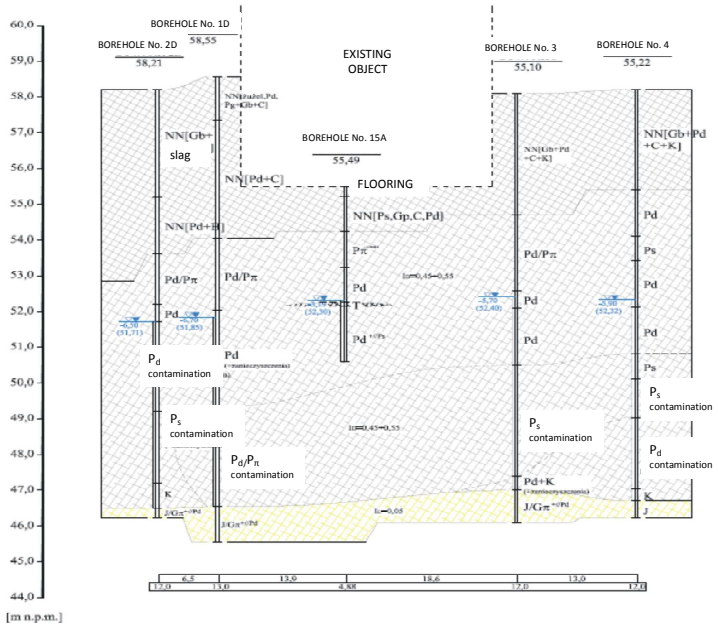

Fig. 9. Geotechnical cross-section under the existing Dressing Room and Bath (Szatnia-Łaźnia)

The analysis (fig. 9) allows statement that the geological structure in the area of Szatnia-Łaźnia (dressing room-bath) building is simple. Under a layer of

embankments useless for construction purposes, which are 5.0 m thick, there is a layer of alluvial sands (fine and medium sands with a layer of stones at the bottom). Below ordinate 46 ÷ 47 m above mean sea level, there is a continuous layer of Poznań Formation loams. Due to this, the geotechnical parameters should be evaluated as complex for the occurrence of a layer of embankments of various degree of compaction, from loose to compacted (i_d = 0,35 ÷ 0,60). Within the area of embankments, at the depth of 4 m below the ground level, there are large chunks of rubble and concrete, which posed a substantial hindrances during the geotechnical site tests. Additionally, former coal stores with deep technological rooms, which are the remaining of the former wagon discharger, were found in this area (fig.6). Also, the area was found to be polluted with specific substances (organoleptic test indicated the presence of oil and phenol) at the depth of 6,5 to 12,0 m. It was also found the maximum level of underground water reaches the building foundations, whereas its minimum level is about two meters lower. Additionally, it was found that the ground water did not reveal any leaching, acid, carbonate, magnesium or sulphate aggression to concrete, but it revealed medium ammonium aggression.

The biggest problem of the underground part of the building were the substantial craks and humidity of the interior walls of the cellar in the extension (isolated shelter rooms), which additionally did not have foundations. Unfortunately, also the other walls at the cellar level as well as some of the ground floor walls were strongly humid, too. Another important issue were the craks on the exterior wall of the gable staircase on the northern side. The morphology of the craks indicated clearly that the area under the foundations was overloaded. Additionally, damages to the exterior walls, from the World War II, were found.

4. MODERNISATION AND RENOVATION PROJECT

In the original project, the following works were planned to be carried out in the existing Dressing Room and Bath building (building C): cleaning and renovation of the brick facade according to the guidelines of the building conservation officer; the replacement of window hardware (the window divisions to be maintained in the external glazing), uncovering and exhibiting the internal steel structure (I-beams and riveted steel columns), and exhibiting partially uncovered brick vaults. Unfortunately, no reliable technical expertise of the existing building Dressing Room – Bath was performed and similarly no serious computational analysis was carried out. Additionally, due to the lack of foundation exposals it was impossible to evaluate the technical condition of the foundations.

In addition, an extension was planned to be built, which was to supposed to consists of two parts: a northern part (Building B) and a southern part (Building A). The northern part was planned to maintain the vertical divisions of the elevation. Fields between the pilasters were to be filled with large glazings referring to the existing building. This part was to be crowned with a bay window with panoramic views of the valley of the River Warta and Ostrów Tumski. The southern part was glazed and based on the circle, referring with its shape to the gas tanks. Building A is a spatial keystone and a dominant in the scale of a quarter (fig. 10, 11). This part houses two conference rooms and a foyer of a large hall on the last floor. The rooms are connected by fan stairs and ramps that run along the outer side of the glass shell (fig. 12). The traffic areas are dedicated to exhibit gas technologies.

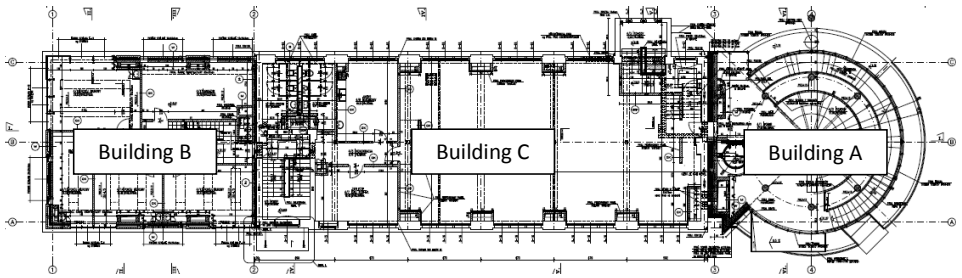

Fig. 10. A layout of the modernized facility together with the northern and southern parts

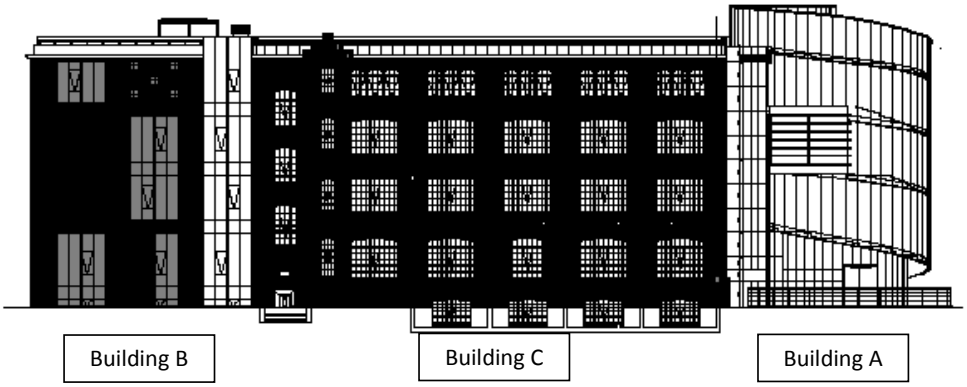

Fig. 11. View of the modernized facility together with the northern and southern parts

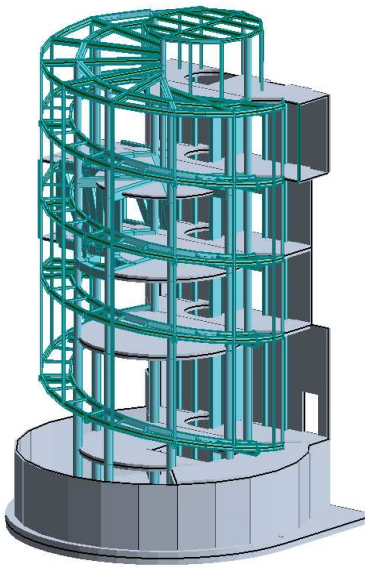

Fig. 12. A model of the structural system of Building A

5. RENOVATION AND MODERNISATION WORKS

Because a reliable technical expertise failed to be performed as well as additional analysis of the foundations of the existing building failed to be carried out, neither the possibility of overloading the subsoil under the foundations in the existing building (Building C) was taken into account, nor it was considered to perform secondary waterproofing in the building or to repair the cracked exterior gable walls (which occurred as a result of overloading of subsoil under the foundations) of the existing building, both in the walls and lintels. The mentioned above works were commissioned by the Investor on his expense. The performed works involved: application of indirect foundations for the new parts of the building, application of a suitable hydro-insulation system in the existing building and in the newly-built parts, repairs of external walls in the existing building, as well as other works such as new solutions for lintels in the passages connecting the existing building with the newly built parts, strengthening of the degraded (due to the designer's errors) existing historic floors and reconstruction of the back side of the staircase.

5.1. Changing the foundations of the new parts of the facility

The carried out analysis of the load bearing capacity of the soil under the foundations of Dressing Room -Bath building, the exterior walls including, showed that it is fully or almost fully exploited. Thus, it was not possible to

build the newly designed parts of the building directly on the existing foundations, according to the performed technical design, without causing substantial damages to the existing building of the dressing room – bath. Because of the above, it was necessary to design the way in which loads exerted on the subsoil by the newly designed parts would be transmitted into its deeper layers, to prevent the cumulation of the values of stresses resulting from loads exerted by the existing building (Dressing room – Bath) and the newly designed parts from exceeding the load bearing capacity of the given subsoil layer. In order to ensure it, an indirect foundation was applied to the newly designed parts of the building which would base on jet grouted columns (Solicrete T), as the safest and the most efficient solution (fig. 13).

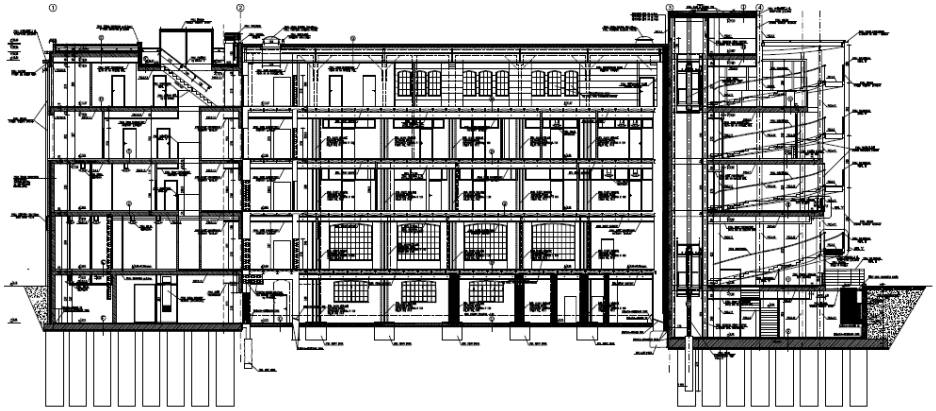

Fig. 13. Distribution of jet grouting piles under part A and B (cross section)

Due to the fact that the subsoil was polluted with oil and phenols at the depths ranging from 6.5m to 12.0 m, it was necessary to consider this fact while producing the *Solicrete* columns, which was realised by assuming the piles to be made of cement CEM I and by using three-stage technology to stiffen the contaminated subsoil.

5.2. Waterproofing

In order to produce tight waterproofing barriers in the existing building, a technology applying horizontal injection siloxane was used and a system of internal and partly external polymer-cement coatings, which simultaneously produced a load bearing layer of the floor on the existing embankments. Before producing the internal coatings, the walls were injected and after the coatings were produced the walls were plastered with an intelligent renovation plaster. Outside, above the ground level, the walls were additionally hydrophobizated (fig. 14).

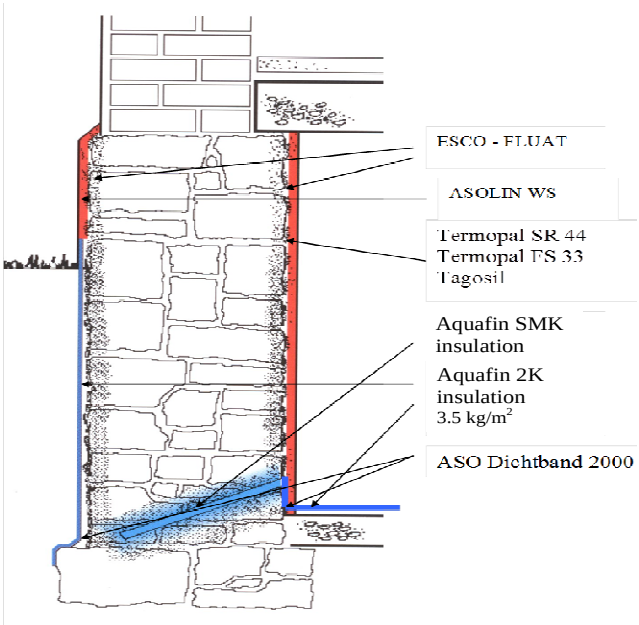

Fig. 14. Schematic waterproofing system in the existing part

In the new parts, a system of polymer-cement coatings was produced, and carefully connected with the new waterproofing system of the existing building.

5.3. Exterior walls repairs

Bearing in mind the historic value of the building elevations, the repairs of the craks on the exterior structural walls were performed basing in the innovatory repairing system PCC connected to system HELIFIX. Connectors, anchors and reinforcing rods, which form the basis of the solutions, are produced from austenitic stainless steel using a unique spiral design Hi-Fin (fig. 15).

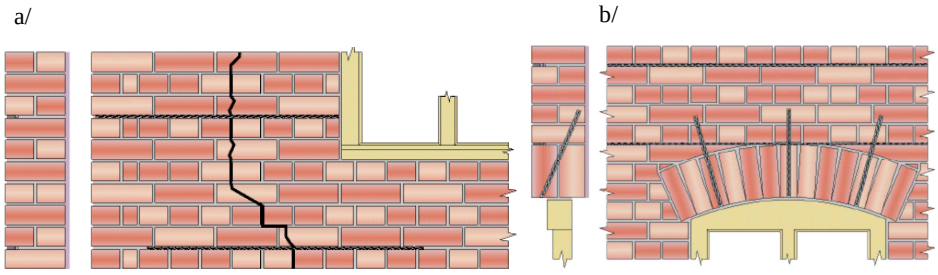

Fig. 15. Repair system applied to the exterior walls
a / walls themselves, b / lintels

5.4. Other works

The biggest misconception was the newly designed lintels between buildings A and C, as well as B and C. The first version of the project included lintels based on a system of I-section, which was totally impossible to produce and could only lead to to destruction or failure of historic building C. On the request of the investor's supervision, lintels were redesigned into a system of two C-sections tightened with screws, thus leading to the formation of composite steel-ceramic lintels. However, the designer planed a monstrous solution based mainly on [240 tightened with bolts M30, class 8.8 (lintels between Buildings B and C). The situation was not much better in the case of lintels between Buildings A and C. Additionally, the designer planned that the screws were to be prestressed with a prestressing moment 2,2 kNm, i.e. generating almost twice the tensile force than the load bearing capacity of adopted screws. During the realization works, a failure occurred yet with the use of a much smaller prestressing moment. A wall between C-sections was crushed, and the web of the C-sections was weakened. Within the investor's supervision they were redesigned and produced correctly.

Due to the poor technical condition and safety risks of the back staircase (fig. 2), it had to be dismantled and reconstructed conforming to all the requirements of the building conservation officer (fig. 16, 17).

Fig. 16, 17. Restoration of the back staircase basing on SCC concrete

In order to connect it rigidly to the main building, self compacting concrete was used (for the first time in Poznań, or even maybe in Poland). It was

impossible to use a classical kind of concrete due to the poor technical condition of the existing building and the fact that various kinds of steel merged with each other (fig. 16, 17). Self compacting concrete provides tight filling of the boarding yet under its own weight, while maintaining high uniformity even if there is a dense reinforcement [11]. It is a unique product especially useful when vibrators cannot be applied, also in the case of erecting additions or expansion of existing facilities, particularly historic ones, and also when formed and reinforced steel merge with each other. On the basis of the formed superstructure, a three-layer wall was produced with an elevation layer made of specially selected face bricks.

6. SUMMARY

Improper decisions of the designer team, inexperienced in renovation and modernisation projects, may result in damage or even destruction of renovated historic facilities. It may also lead to excessive expenses for the Investor. An example of such a situation has been presented above. Only through effective services of the Investor's supervision, the Investor's good will and their financial capacity, it was possible to carry the successful renovation of the modernization process of one of the most interesting post-industrial objects in Poznan in the Old Gasworks. Despite this, the realised investment received two national awards: „Modernizacja 2011" under the auspices of the Ministry of Infrastructure and a honourable mention in the competition: „Zabytek Zadbany 2012" in the category "Industrial Architecture and Technical Heritage" under the auspices of the National Building Conservation Officer.

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RENOWACJA Z MODERNIZACJĄ BUDYNKU POINDUSTRIANLEGO W POZNANIU

S t r e s z c z e n i e

W pracy przedstawiono renowację zabytkowego budynku poindustrialnego znajdującego się na terenie Poznańskiej Gazowni. Nieprzygotowany zespół projektowy popełnił wiele błędów i zaniechań, co doprowadziło do dodatkowych prac, w tym naprawczych. Zwiększony zakres prac doprowadził również do znacznego zwiększenia kosztów realizacji przeprowadzanej renowacji. W trakcie realizacji prac zastosowano wiele nowoczesnych technologii, niektóre po raz pierwszy na terenie Poznania.

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REVITALISATION ISSUES OF SETTLEMENTS BUILT IN 1946 – 1974 IN TERMS OF SOCIAL AND DEMOGRAPHIC CHANGES

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The paper refers to the issues of forming the revitalisation programs of settlements in particular houses built in 1946-1974 in terms of the understanding of social – demographic changes which have been taking place in a modern society. Paragraphs 3 and 4 contain the description of general social and legal factors which influenced the shape of a family and the residential structure built in 1946-1974. Paragraph 5 is devoted to the predicted changes in the family sizes and the functions predicted by GUS (Central Statistical Office) which are taking place in light of progressive egalitarian relations in a family. The sixth part shows strong and weak points of residential buildings which were built in 1946-1974 in relation to the new family models. The conclusions include main directives, which should be followed, when the revitalisation activities of such objects are formulated, dedicated mainly to the increasing target groups with specific needs: elderly people and childless, economically active young people.

Keywords: architecture, revitalisation, demography, modern family

1. INTRODUCTION

Reflecting on the implementation of revitalisation projects within the settlements built in 1946-1974, some of the social-demographic aspects of the issue which may release their potentials deserve thinking over. The date 1974 is a rather presumed limit more connected with the implementation of some urban and housing norms, which will be discussed further, as well as with the spread of prefabricated construction techniques – panel buildings, which may themselves be the subject of a separate elaboration due to the different set of problems of social and technical nature.

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2. SOCIAL SITUATION IN THE AFTER-WAR PERIOD

Reading “Sociology of a family” by Tomasz Szlendak [1] we realise, and in fact often intuitively notice, that the family which is indirectly designing its basic tool – a house or a flat, being the aim of our work, is not that definable and stable as some people think, but is a dynamic, changeable formation, in which relations and mutual interdependence do not change only with time and according to its particular stages, but also due to the general changes taking place in the society. It is not the architect's job to analyse the reasons and results of these changes but we should be aware of them, so to skilfully react on the processes through suitably designed houses. As far as the existing objects are concerned, we should think how to exploit them and how to transform them so that their potentials would be best exploited. Looking at the construction industry in the period after World War II, we should remember that it was formed in determined social, demographic political cultural and economic conditions.

Not only was the number of houses in the interwar period insufficient, but many of houses were destroyed in war operations. The ones that preserved, were managed in such a way that they would have accommodated the largest number of people. Additionally, as a result of border changes, we must remember about the great migration of the population from the eastern territories to Silesia and “Regained Territories”. An excellent picture of the migration we can see in the Ethnographic Museum of Opole Silesia. People brought not only their culture, possessions but also their fear and uncertainty of the future. However, such towns as Gliwice, Wroclaw gained immensely in this mixing of cultures where the tradition of Silesia met with Lviv, forming a new quality. The post-war trauma caused a kind of "conservative rockburst” (T.S s. 353) within which, the family model and mutual relationships should resemble those of the Victorian era. The 50s harden the “traditional” roles of a mother, best with a few children, and a man “*the only breadwinner to the household*” (T.S s. 356). Simultaneously, much pressure was put on “demographic reconstruction”of the country: “*In 1950, the rate of live births in Poland exceeded even the American record and was 30.7 per 1,000 people”* (T.S s. 353 after Duch Krzysztoszek 1998 s 31). In 2009, the birth rate was 10.9 [2]. It should be remembered that it all happened in the reality determined with the political system which we had at that time, and which contributed to the isolation of ideas. Changes which started to take place in the western societies yet in the sixties, did not reach our country until the nineties, thus the more dramatic they seem today.

3. CONSTRUCTION INDUSTRY OF THE AFTERWAR PERIOD UNTIL 1974

The PRL times, and particularly the 50s, were the period when every aspect of life, and especially social life – construction including, was under political control. Fast development of towns and the growth of industry, which were followed by the migration of population to towns, were the priorities of the authorities. Apart from the development within the existing towns, new totally artificial formations appeared, e.g. the town of Tychy was established by the resolution of the Government Praesidium of 04.10.1950 and the Regulation of the Prime Minister 09.11.1950 *"In order to improve the living conditions of the working class of the Central Coal Basin"* [3]. In order to establish new living space "appropriate" for socialistic society, new norms were sought for with which the constriction process could be kept under control. Act of July 3, 19471 was the base for the activities. It imposed a requirement on the Minister of Reconstruction to formulate building standards. It resulted in the announcement of instruction of 10 September 1947. Not only did the Instruction formed the spacious norms for particular standards of flat categories, but also stated the quantitative relations for the particular categories in the new designed residential complexes. It is worth mentioning that not only a living room or a bedroom was considered a room but also the kitchen if it had a window and was separated with walls.

Table 1. Norms for flats from 1947 [5].

Flat category	Usable space in m²	Out of which living area	Sample numerical solution
I	22	16	1 or 1.5 rooms
II	35	24	2 rooms
III	41	28	2,5-3 rooms
IV	48	32	3-3,5 rooms
V	58	40	4 rooms

The norms allowed designing rooms lesser than 8 m², e.g. bedroom annexes, which had to be opened to other spaces, though, but could be designed without windows.

A flat of type III was considered to be the basic one and so was decided to be built in 3/5 of the newly erected blocks of flats, whereas the proportions for types I + II and V amounted 1/5 each. Simultaneously, a committee was formed within the Institute of Housing, which was to elaborate new standards. The

assumptions the committee made are worth citing here as they reveal the picture of the criteria they used [6]:

1. *„The average floor area should not exceed 11.3m ² per person.*
2. *A minimum living space per person amounts 7m ², and it is expected to be enlarged to 8.5 m² and then to 10.5 m² per person.*
3. *Each family receives a separate apartment.*
4. *Every citizen, regardless of age is considered a person.*
5. *A bedroom for 3 people is considered unacceptable, with the exception of marriage with a child under 5. It is unacceptable or at least highly inappropriate that two persons sleep in one room, especially persons more than 12-14 years old, of the opposite gender. Also, sleeping in the kitchen is unacceptable ..... "*

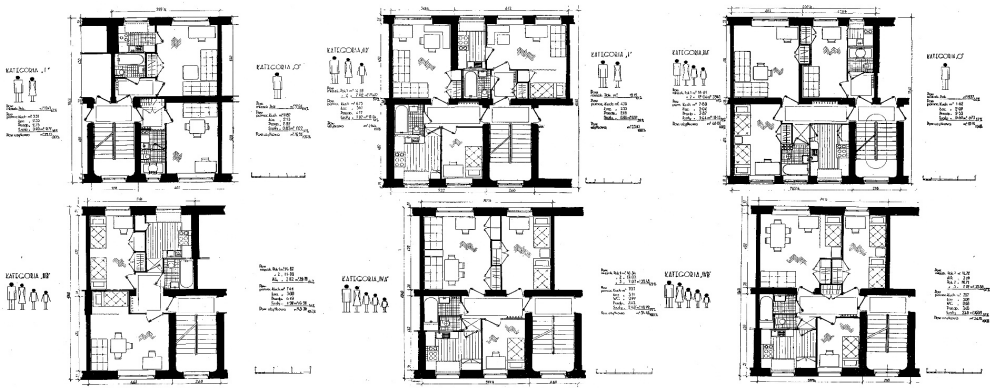

Fig. 1. Examples of flat plans elaborated by the Institute in 1950. Illustrations are taken from the „Report of the Committee of Housing Standards volume 1 IBM Warsaw 12 1950 Book 1”

The additional results of the committee's work were the architectural solutions for flats elaborated by engineer Szperling (IL.:1), some of which are presented below. These solutions were in use for many years. The proposed by the Institute standards were accepted as a flat norm in 1954 [7].

In both cases, a living room meant a bedroom for parents, which did not provide expected privacy. Looking at the housing structure, we can see that single-room flats and double-room flats composed 80% of the total number of flats, which for the average family (2+2) presented a considerable housing problem. The situation became even worse after introducing the standard in 1959 [8]. It introduced the limit of 44m² for a flat in the newly designed buildings and settlements. It was then that the nomenclature was introduced to determine a flat by the number of its residents.

Table 2. Comparison between the results of IBM work and standards from 1954 and 1959

Committee of Housing Standards (IBM) 1950					Standards from 1954					Standards 1959		
Flat type	Flat component	Usable surface	Living space in	Kitchen area	Flat type	Flat component	Usable surface	Living space in	Kitchen area	Flat type	Usable surface m²	Number of dwellers
0	P+WK	18-20	12	05	P	P+WK+WC	18-22	14	10%	M1	17-20	1
I	P+K	25-27	15	4	PK	P+K+Ł	28-39	18	43%	M2	24-30	2
II a i b	P+Pj+K	35-38	21	6	2PK	2P+K+Ł	41-50	28	37%	M3	33-38	3
IIIa i b	2P+K	44-48	28	7	3PK	3P+K+Ł	51-58	36	10%	M4	42-48	4
IV a i b	2P+Pj+K	53-58	35	7	4PK	4P+K+Ł	59-66	45	do 2%	M5	51-57	5
										M6	59-65	6
V a i b	3P+Pj+K	63+68	43	7	P- room , Pj single room - bedroom, WK kitchen annex , K- kitchen, Ł- bathroom					M7	67-71	7
VI a i b	3P+Pj+K	75-80	49	8								

Looking at buildings from the period 1945-1974, it can be noticed that they frequently do not compose large settlements, although sometimes they initiated their development. A lot of settlements were built within the after-war restorations, often as single buildings or as a small group next to the existing buildings. Additionally, many of them, since they were built as the first ones, are best located and are best communicated with the rest of the town.

The year 1974 is the date which separates the post-war period in the building industry for two reasons. The first one is that this is the year when new building and town planning standards were established, which serve as a cornerstone for new large settlements [9], and the second one – is a widespread usage of panel building. The difference between these two periods is vivid enough to consider the problems occurring in these estates as separate problems of space in town planning, structural-technical, and social.

We can read more on this topic in papers by Władysław Korzeniowski (Budownictwo Mieszkaniowe Poradnik Projektanta) or Andrzej Tokajuk (Zespoły mieszkaniowe z lat 1945-1970....)

4. DEMOGRAPHIC AND SOCIAL CHANGES AFTER 1989.

The year 1989 is a special date for our society not only because of the political transformations that took place in our country. It is also the date after which the effects of these changes have a huge impact on most areas of our lives. The collapse of the planned economy and thus the heavy industry and mining, which were the basis of employment in urban areas such as Silesia, results in the fact that those who migrated to these centres in search for work began to leave them. For instance, in 1988, the population of Silesia was 4 907 919 [10] people, whereas twelve years later, in 2010, it was 4 635 882 [11] people. The difference 272 037 can be compared to a medium-sized town e.g. Częstochowa. The drainage of the town residents is tightly correlated with the size of businesses which located in various towns. The prognosis prepared by the Central Statistical Office foresees the further decrease in the number of population in 2008-2035 [12], to reach the number of 4 052 211 people, i.e. by 855 708 people fewer. It is as if a towns such as Katowice, Sosnowiec and Częstochowa were depopulated. What is additionally significant, is the changes which are taking place in the structure of the population. The prognosis says that the percentage of elderly people in the population structure will increase whereas productive group will shrink.

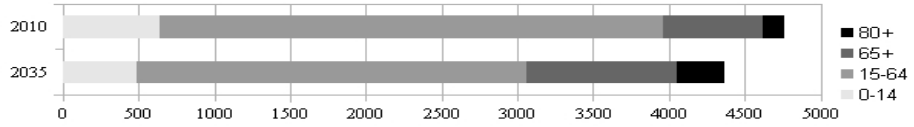

Fig. 2. Population structure in Upper Silesia in 2010 together with the prognosis for 2035

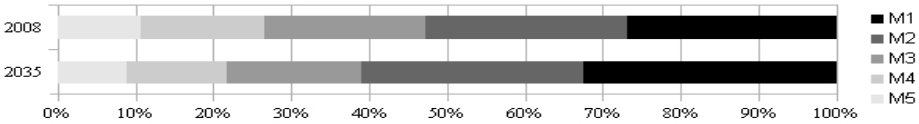

Fig. 3. Structure of household sizes in 2008 and prognosis for 2035

The changes are followed by the expected changes in the structure of households. As can be observed in Fig. 3, the vast majority of households will fall into the group with 3 residents, whereas flats with one or two residents will compose 61.2% of the total number of flats. There are numerous reasons for this

situation, although they are mainly related to the progressive globalization and the changes that take place within the family – i.e. mutual relationships of their members. It is not a local problem, although the strong changes which are taking place refer to countries well rooted in Catholicism and patriarchal traditions. The fertility rates of women are significantly decreasing in these countries [T.S. pp. 367-369], simultaneously, the marriage institution is becoming more and more unstable, and the divorce rates are considerably rising. *"In just 1998, the numbers of divorces in particular countries were as follows: 578 (in 1000) Finnish marriages, 525 British, 563 Hungarian, and 584 Russian"* [T.S. p. 370] *„It is estimated that 300 marriages out of 1000 get divorced currently in Poland."* [T.S. p. 372]. The number of people who decide to live as singles is considerably increasing, which refers mainly to women, and also people who live together but do not get married. People tend to get married later and later, if at all. A model of an egalitarian family is formed, in which all the members are respected, as well as their professional choices and lifetime ambitions, and also various alternatives for what was previously called a classical nucleus family. Each of the models will approach the living space in a slightly different manner. We, the architects, understanding the new demands, should consider them and reflect in our work. What will connect these models is definitely the general trend to individualise the space providing intimacy for their residents, and also transferring the traditional functions of a family to external institutions.

5. CONSTRUCTION INDUSTRY IN 1946-1974 IN LIGHT OF NEW FAMILY MODELS

Looking at the issue from the point of the anticipated demand for flats, it should be noticed that what was the curse of its times – a minimum surface of a flat - , may now be the biggest trump of the facilities built in the after-war period. Obviously, the settlements, or particular buildings have their strengths and weaknesses.

5.1. Strengths :

- The most probable strong point, apart from the surface, is their central location in the town structure, as they were built at the beginnings of the urbanisation process.
- The facilities are usually well communicated with the rest of the town, or are located within a walking distance.
- The settlements are surrounded by well developed green areas, although frequently neglected.
- To a large extent the estates have a well-established social structure of a peaceful nature.

- The general technical condition of the facilities (in construction terms) is satisfactory.
- Some of these estates, especially the ones which were particularly solicitously designed, may, with their unique architecture, deserve a respect to be referred to as "cult estates" and after modernisation their attractiveness may vanquish even modern buildings. A good example of such buildings may be “Superjednostka” in Katowice, designed by Mieczysław Król in 1972 and recently modernised.

5.2. Weaknesses

Obviously, such estates have their weak points, too. They should be solved and corrected within revitalisation works:

- A barracks-like layout of the buildings shapes the space giving it impersonal appearance, which also refers to the shape of the buildings themselves.
- As a result of a weak commitment to the development of spatial order of these settlements, attention should be paid to a very poor arrangement of space around the buildings – damaged sidewalks, lack of playgrounds or meeting places.
- Extremely limited parking places. What refers mainly to older buildings.
- Although the overall small living space of these flats is their strong point, it should be noted that a large part of the premises do not meet the currently accepted standards. It particularly refers to rooms such as kitchens, bathrooms, and bedrooms. Frequently, there are no balconies.
- The buildings are in a very poor condition in terms of their technical infrastructure. Starting with such issues as carbon-fired ovens which were built due to the lack of gas supply, finishing with hazardous gas-powered water heaters. A part of the buildings were heated by inefficient and polluting coal-powered municipal heating plants.
- Thermal parameters of buildings, especially of the ones from the late seventies, are very low. It may be an additional problem, as these particular buildings often have "deliberately designed modernist facade" showing the structure or texture of the materials. (eg, buildings designed by a team of Majerski Duchowicz at Stawowa Street now Dunikowskiego Street in Gliwice).
- Poor accessibility for the disabled and elderly people – buildings do not have elevators and their ground floors are often raised.
- Such buildings are often in the poor areas of the town, which reduces the value of the neighbourhood, and thus blocks the financial capacity to carry out the necessary repairs.
- Dispersed ownership structure which may present a significant obstacle for the decision about carrying out the repair works.

6. CONCLUSIONS

Viewing the problem from the perspective of social changes, there are two possible target groups in terms of the demand for small apartments. However the two groups have different requirements in terms of urban and living spaces.

The first of these groups comprises elderly people, who present a very traditional approach to the living space. Obviously, these people have their specific needs which should be met when revitalising a building. This group is characterized by the fact that individuals are often lonely, after they lost their spouses, and it is very important for them to have the opportunity to maintain relationships with other persons at a similar age. It is important from the point of view of the group to provide these contacts within the municipal area. Additionally, it is important that the surroundings is safe and quiet with the utility facilities within a walking distance (shops, medical services, meeting places). Adjusting the internal structure of these buildings and their infrastructure to meet the needs of elderly people, in the context of their potential disabilities, seems to be challenging, though not hopeless, due to their traditional constructing technologies. The key is to install a lift and reconstruct the sanitary facilities. Elderly people, due to their lower material status, often cook their meals at home. Also, they more frequently pay visits, so the kitchen area and the living room require a good solution.

The second group of people who might be interested in such revitalization projects are active young people living alone or in pairs, referred to as DINKS (Double Income No Kids). The average size of such apartments ranges 40-44 m² with two rooms is rather intended for families with no children if the twenty-first century living standards were to be maintained. From the point of view of town planning, the important issue for such persons is the proximity to their work places and utility facilities in the town centre, due to their specific lifestyle. Because of their young age, they put less importance on a peaceful and secure neighbourhood and more on the architectural quality of the object itself - hence the phenomenon of “Superjednostka”. They will also consider the standard of finishing as a significant issue. While older people spend more time at home or in the neighbourhood, this group treats the living space differently. Due to the strong commitment to work, home remains the mainstay of everyday rest (sleep) and possible contact with the nearest person. Much less time is spent on the preparation of meals – it is pointless to expect from anyone to cook a "full-sized dinner" after coming back late from work. The kitchen may be marginalized here to a row of cupboards including a kitchen working space. These people are more often willing to take an active vacation away from home (sports trips, etc.). Similarly, relationship with friends are transferred to clubs , pubs and restaurants. The separation of the daily area from the intimate area is of less importance than it was in case of elderly people.

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PROBLEMY REWITALIZACJI OSIEDLI MIESZKANIOWYCH Z LAT 1946-1974 W ASPEKCIE ZMIAN SPOŁECZNYCH I DEMOGRAFICZNYCH

S t r e s z c z e n i e

Artykuł dotyka problematyki możliwości kształtowania programów rewitalizacji osiedli i poszczególnych obiektów mieszkaniowych z lat 1946-1974 w oparciu o zrozumienie zmian społeczno demograficznych, jakie zachodzą we współczesnym społeczeństwie. W akapitach 3 i 4 opisano ogólnie czynniki społeczne i prawne, jakie miały wpływ na kształt rodziny i struktury mieszkaniowej powstałej w okresie lat 1946-1974. Akapit 5 poświęcony jest przewidywanym zmianom w funkcjonowaniu i wielkości rodzin- „gospodarstw domowych", jakie są przewidywane w oparciu o prognozy GUS i zachodzące w ramach postępującej egalitaryzacji rodziny. Część szósta pokazuje silne i słabe strony zabudowy mieszkaniowej z lat 1946-1974 w relacji do nowych modeli rodziny. W ramach wniosków przedstawiono główne wytyczne, którymi powinno się kierować, w ramach formułowania działań rewitalizacyjnych, takich obiektów, dedykowanych dla powiększających się i specyficznych w swych potrzebach grup docelowych: osób starszych i aktywnych zawodowo bezdzietnych osób młodych.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

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REBIRTH OF POSTIDUSTRIAL ARCHITECTURE IN POLISH TOWNS. Adaptation of a historic building of a power station into a modern art galery in Radom

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The transformation of city centres in Poland has taken various forms over the last 20 years. The specificity of the physiognomy and historic-spatial conditions imposes a certain direction of those transformations. They shape the public space of the modern towns and cities starts with glass-sky-scrapers to various forms of revitalisation of old buildings. More and more frequently, the space is enliven with splendor of newly revived industrial facilities. The adaptation of the existing industrial facilities to new functions creates new cultural space thanks to their individual and unique quality.

Keywords: post-industrial architecture, industrial architecture, adaptation, renovation

1. INTRODUCTION

The existing facilities of industrial architecture occur in many Polish towns, and definitely in the bigger ones. Their beginnings in Europe should be searched for in the times of Industrial Revolution. In Poland, though, slightly later – in the period starting from the second half of the 19th century up to the beginnings of the 20th century. They owe their exceptional architectural forms to the functions they were intended for. They housed industrial plants, technical appliances, and machines therefore they were built from modern (as for those times) building materials. Large areas were obtained thanks to the application of large-span elements forced the designers to use the latest structural solutions. Seemingly crude elevations, not devoid of architectural detail though, were often limited to the use of clinker brick walls. A large floor area of these objects extorted the usage of large glazed areas on facades.

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Fig. 1. Centrum Manufaktura in Łódź / source: www. wikipedia.org / HuBar /

Adding considerations for shaping the facade of these facilities in the form of repetitive axial rhythms of window components and technological appliances, accuracy has been achieved while measures have been conserved in dealing with architectural expression.

The traditional form of industrial plant is a high one-storey production hall of a frame construction. It can be concluded that the buildings completed by the 50s of the last century were characterized by a smaller scale of building [1].

The central location of a property and access to the object from all sides allow the use of simple adaptation measures. The location of these objects once on the periphery, today as the progressive urban development processes, has become their undoubted advantage. Being located within the intermediate zone of cities but still in the city centre, they allow better access for the dwellers. Industrial facilities distinguish not only by its architecture, often for many years they served people with their proper brands.

With the development of technical ideas, the equipment of these facilities has become obsolete or sometimes even useless. Technical wear and progressive collapse of the building led to their depreciation in the city structure [8]. Some of them had a chance to be classified as historic monuments and thus to survive, others have been destroyed for the brick. Therefore, in order to restore them to their former glory, it is necessary to carry out technical expertise and implement conservation procedures preceded by adequate research and design studies [2].

2. POST-INDUSTRIAL ARCHITECTURE – A PROBLEM OR A CHANCE?

Abandoned industrial sites common in most Polish cities can be a significant problem for the owners. Significant areas of the parcels and their usable dimensions generate considerable costs, starting with taxes, through exploitation costs to large financial expenditures related to the adaptation of these objects to new functions.

Nowadays, in the times of growing commercialization, it is not easy to find new purposes or roles, which the objects could provide. Small objects are eagerly adapted (finding quickly new owners), due to their function and greater spatial clarity.

The term - post-industrial architecture - is highlighting the unique qualities of objects and granting them new functions. The new value that the buildings present through their presence in the urban development is also a new phenomenon that can best be explained on the example of Silesian towns. Giving these objects new values enables us to use another term – the renaissance, i.e. their rebirth to their new roles.

3. CONTEMPORARY TENDENCIES IN INDUSTRIAL BUILDING RENOVATIONS

As a large-scale objects: steel mills, coal mines with shafts, mills, breweries, power plants, etc., these buildings dictate their application and adaptation possibilities.

Current trends to design cost-effective architecture, i.e. crude not to say minimalistic, present themselves as some kind of opportunity for the development of these facilities. Non-plastered walls with regular joints, exposed bare structural components, steel riveted lintels, segmental lintels, ornamental cast iron cantilever elements all create a unique appearance as well as the unique atmosphere of the interior [6].

Objects of residential architecture created as so-called lofts have long ceased to be the homes for people from elite and avant-garde. They are increasingly becoming apartments for young, creative people, seeking unconventional solutions and innovative adaptation of interior design. At the beginning of the twenty-first century, such apartments were in demand and were more willingly bought than single-family houses. The situation changed radically with the advent of the economic crisis and the impoverishment of the young.

The next group of buildings includes large objects of a commercial nature. Enormous commercial spaces, so-called “galleries”, began to quickly conquer urban spaces forming complexes - centres which, with their

dimensions, go far beyond these industrial facilities. Their task is to create an atmosphere and ambience, to arrange the space, and sometimes even to give them their old known brands. Obtaining a sufficiently large space in city centres can be a problem, hence the adaptation of the whole post-industrial complexes. Supplemented with essential multi-level garages, they are becoming places of social life for meetings, shopping, and sometimes even spending free time, just modern temples of commerce.

Another group comprises objects for exhibitions and museums. They have recently been willingly erected because of the possibility of obtaining a grant from EU programs. Here also providing an appropriate architectural expression must be combined with the specific nature of the interior design and with the detail reproduction. Huge areas of former halls, supplemented by natural and artificial lighting are ideal for this function.

Industrial complexes of an urban-nature character, seem to be completely different objects. Factories hidden on the outskirts of the city or beyond their borders, pose a challenge for designers in relation to the created cultural theme parks. The connection of individual objects into a group surrounded by greenery while providing them with new ideas, causes that they may be used for various purposes such as staging of historical events or conducting a lesson.

The last group consists of individual objects such as water towers, gas tanks, small production workshops, forges, which are often appreciated by private investors. Often used as a catering points or small hotels are a real pride of the city. In the case of water towers one can not forget about the unique composition features such as:

- clarity in the landscape and the silhouette of the city as the spatial and altitude dominant
- as a convenient central location in the city
- often a combination of functions and viewpoints.

Table.1. Systematics of objects with their attributes and location.

Group of post-industrial objects	Scale and features	Location within the town borders	Examples of realization
1	2	3	4
Lofts and dwelling houses	Multi-storey objects with numerous communication tracts or single objects	Throughout the entire city	Throughout the entire country, vast majority in big cities
Commercial and service centres	Multi-storey objects with numerous communication tracts or complexes of objects	Outskirts but also downtown	- “Centrum Manufaktura” in Łódź - “Stary Browar”in Poznań - “Alfa” in Białystok

Exhibition – museum	Multi-storey objects with numerous communication tracts	Throughout the entire city	- Museum of Warsaw Uprising - "Fabryka Drutu" in Gliwice - "Fabryka Trzciny" in Warsaw - WSP Gliwice
Industrial complexes of urban-nature character	Complexes of objects surrounded by greenery	Outskirts or outside the city	Exploseum w Bydgoszczy
Catering and hotels	Single, small, sometimes combined with a viewpoint	Outskirts but also downtown	Throughout the entire country e.g. water tower in Wrocław

4. THE IMPORTANCE OF POST-INDUSTRIAL OBJECTS FOR URBAN SPACE

Functioning for decades, these objects are identified with their particular location. Clear and recognizable in their distinctive architectural form, they create public spaces.

Through their functional features they indirectly influenced their surroundings. Therefore, it is possible to differentiate separate industrial zones of the city, sometimes whole town districts. Larger industrial facilities were surrounded by housing districts but also by the necessary social infrastructure. More recent extensive industrial units built in the last 50 years were characterized by scale only.

Today, after the period of economic transformation, these urban areas may present a problem of extensive revitalization. Single older objects are in a slightly different situation. There is a number of investors who often and gladly place their businesses and offices there. The distribution of industry on Polish map allows identification of specific areas with a large concentration of these objects such as Silesia, Łódź and surroundings, Poznań and Białystok.

The Silesian agglomeration can even be referred to as a post-industrial city which is positively being transformed before our eyes, improving its public space by applying individual innovative solutions involving these objects [4]. Modern objects with heterogeneous functions located in defined zones or town districts may, however, be understood as „hybrid buildings" without a strong leading function [7]. These are the discussed group of objects, among which it is impossible to distinguish specific mono-functional buildings. Their immediate vicinity, spatial and transportation relationships lead to the transformation of the public space.

In the case of higher concentrations of such objects, the phenomenon can be defined as space hybridization. The new urban phenomenon, which has been poorly researched, can be perceived as both positive and negative. However, the scale of the newly built hybrid buildings may give rise to much controversy.

5. MODERN ART CENTER "ELEKTROWNIA" IN RADOM

Medium-size towns with up to 250 thousand inhabitants preserved their character of urban building in most cases in Poland while maintaining an appropriate scale. The industrial objects, built decades ago, are mostly single buildings.

One such example is the building of the former power plant in Radom. Located in the city centre, it managed to establish its position in the town's cultural landscape. Surrounded by tenement houses, it exhibits its architectural qualities characteristic for industrial architecture.

Due to the lack of ideas of how to use it, on the one hand, and the lack of a large showroom or a museum on the other hand, Local Authorities of Mazowieckie Voivodship decided to create an exhibition centre of contemporary art. The main part of the historic building consists of three interconnected blocks, two of which are interconnected buildings, several meters heigh, which form the main body the object. It was extended by a bungalow building with a lean-to roof. The subject building, made of brick, with thick solid walls with characteristic large areas of glazing, is a monolith [5] of a characteristic recognizable lofty silhouette.

Fig. 2. Modern Art Centre "Elektrownia" in Radom,
view from Traugutta Street /source www.wikipedia.org /Gazelle/

The building is a place where electricity and heat for the town were produced for many years.

Its origins date back to 1901 when the town was lit with electricity from this power plant. Most of the technical equipment i.e. generators and other were sent to Russia yet before the outbreak of the First World War.

The property was taken over by the Radom Community was not until after the end of World War II. In the years 1956 to 1963, the abandoned building fell into disrepair. From 1963 to 1998, it served as a municipal heating plant. In the subsequent years, it functioned as conference facilities of the city's enterprise Radomskie Przedsiębiorstwo Energetyki Cieplnej, until 2005 when its ownership was transferred to the Management Board of Mazowieckie Voivodeship.

5.1. Design solutions for competition

The aim of the project selected in competition was to combine the existing historic building with modern architecture.

Static heavy masonry hall was supplemented by a number of smaller black dynamic elements made of perforated black sheet in the new part.

The created kind of counterbalance between the old representative part and the modern exhibitional part can be felt both in the spatial composition of solids and in the interior design. The entity is united with the conception according to which the exhibitional part enters the open space of the cinema terrace and further with the open landscape of the park on a slope.

The intermingling art and street spaces should be realised by transparent forms of the passageways in a form of blocks based on triangles.

Fig. 3. A winning model of the design competition - CSW “Elektrownia” in Radom / source www. elektrownia.art.pl /

The historic brick building is designed to serve as the building entrance. A skylight, clearly underlined with a longitudinal axis in the ceiling, is designed to emphasize the external axis of the composition.

The interior of the facility should be read as an element unifying the particular blocks of buildings. Compositional axis of the skylight leads the visitor to a place which is probably the most important i.e. education part. The intermingling of the spaces in this part is coupled via a staircase lit from above. Going further we have a chance for a wider opening onto the park.

After analysing the project, it can be stated that the authors' aim was to create an attractive friendly place in the city, which would be designed not only for art celebration but also for relaxation and education.

6. SUMMARY

The apparent fashion for postindustrial style allows restoration of the architectural splendour of many objects.

The success of the adaptation project is determined by such factors as: the size, and the scale of building area, the location in the town's structure, the future function and financial expenditure on renovation of the facility.

The most appreciated fact is that, apart from public functions, the new objects are given more and more frequently residential functions. The popularity of post-industrial architecture can be explained not only in terms of fashion for frugal style but also in terms of the use of natural building materials, designed open interiors as well as of the external decoration rich in details. The restored architectural details may receive their second lives in new adaptations, thus proving the craftsmanship of their builders and the contribution to the cultural heritage of the towns.

The described characteristics of the facility in Radom in light of general background, presents a less-known example of the development of post-industrial buildings and its specificity.

Summarising, it should be stated that the new realisations of post-industrial architecture provide a modern look to the restored facilities, raising at the same time their status, and serve as positive examples of the revitalization of the towns. New functions of post-industrial architecture result in its ennoblement and sometimes its appreciation. From the point of view of utilitarian architecture, these buildings are entering into the world of art architecture [3].

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RENESANS ARCHITEKTURY POSTINDUSTRIALNEJ W POLSKICH MIASTACH
Adaptacja zabytkowego budynku elektrowni
na Centrum Sztuki Współczesnej w Radomiu

S t r e s z c z e n i e

Referat stanowi próbę podsumowania tendencji w renowacji i adaptacji architektury przemysłowej w Polsce .Na wstępie autor odnosi się do zastosowanej terminologii i uzasadnia tytuł referatu. Jest to również próba dokonania systematyki nowych obiektów oraz ich lokalizacji w obrębie miasta (architektura przemysłowa czy poprzemysłowa). Wprowadzane nowe funkcje stają się szansą w tworzeniu nowych przestrzeni publicznych, ale również kreacją w budowaniu nowych form architektonicznych (renesans architektury). Pozytywne ale również negatywne zjawiska związane z alokacją poszczególnych obiektów stanowią podstawę do kształtowania przestrzeni miejskiej. Niezależną częścią referatu jest próba oceny rozwiązania architektonicznego realizacji konkursowej adaptacji budynku elektrowni na potrzeby centrum sztuki współczesnej jako przykładu realizacji w miastach mniejszych. Stanowi to również potwierdzenie tendencji do odradzania się architektury poprzemysłowej w zupełnie nowych odsłonach i nowych wartościach przestrzennych.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

No. 9 2012

APPLICATION OF MODEL METHODS IN DESIGNING AND MODERNIZATION OF BUILT-UP AREAS

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Processes of spatial planning and modernization of built-up areas require a complex combination of issues important for the development of sustainable urban structures, such as: ecological constructure, wind climate (Environmental Aerodynamics), land development. The presented analyses refer to numerical (CFD) and experimental (in a tunnel) methods of modelling the air flow in a space between buildings. The subject of the research is a part of a built-up area consisting of a tandem of two buildings of different heights and exhibiting the "down-wash" effect.

Keywords: modelling methods, spatial planning

1. INTRODUCTION

Spatial palnning and modernisation of built-up areas require a comprehensive approach of numerous diverse disciplines that make up the functioning of the municipal entity. They are such spheres as: economy, society, ecology covering broad aspects of sustainable development (including transport and construction). Dealing with these problems and their implementation are of particular significance, not only because of the improvement of living conditions in the cities and the quality of the public space, but also because it is an important factor in rising the competitiveness of cities. Among such issues as: urban regeneration, the optimal location of buildings or laying out routes, which are the concerns of architects, engineers, urban planners, also recognition of local wind conditions should be taken into account. To environmental factors that make up the ambient atmosphere of buildings, include the following: wind speed and direction, air pollution, wind-lifted raindrops and sunhine. Each of these factors depends on the shape, dimensions and orientation of the building

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in relation to the wind inflow direction and its interaction with other objects in their vicinity, such as other buildings, trees or landscaping elements [3]. Increased wind speed around buildings leads to feelings of discomfort and may even pose dangers to pedestrians, while the reduced wind speed causes the accumulation of pollutants of various origins, such as gaseous pollutants, dust, wind-flying garbage, sound effects, etc.

This issue is important because of the increased public interest in functionality of the buildings and surrounding areas, forcing architects, engineers and urban planners to consider a number of often conflicting factors and searching for the solutions which would ensure the quality of life for residents (figure 1).

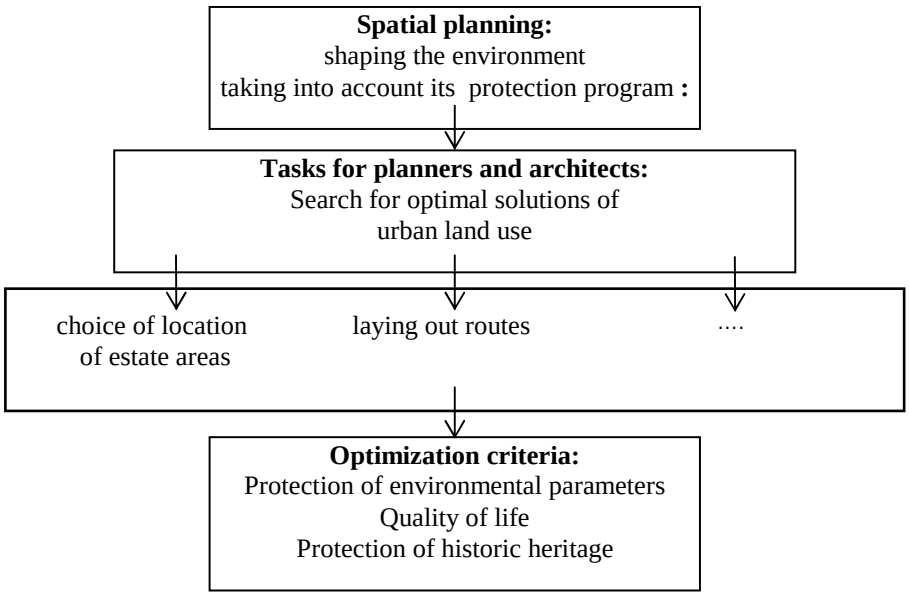


Fig. 1. A chart of planning and modernization of built-up areas. Source: own elaboration

Spatial planning and modernisation of built-up areas and any related engineering processes (architectural design, land development) constitute an important concern for urban planners, designers and constructors. In addition, knowledge of the aerodynamics of the environment can help shape the ambience and wind climate of urban facilities suitably in order to provide their users with the appropriate comfort [1, 4-5]. The article emphasises the importance of this problem in the process of planning and modernization of the built-up areas. The paper presents experimental and numerical methods for determining local wind

conditions in urbanized areas, and proposes a method of selecting optimal configuration of structural elements providing adequate comfort for their users.

2. PROCEDURES OF MODELLING METHODS

Traditional modelling methods of environmental research in built-up areas, base on research conducted in the wind tunnel applying similarity criteria. Among the most widely used experimental studies are visualizations such as: smoke, oil, and using threads sticked into the model, the determination of pressure distribution on the walls and roof of the building and the surrounding subsoil, measurements of speed, turbulence and stresses. A typical configuration of the wind tunnel with an open circuit used in the modelling of a ground-level layer is shown in Figure 2. The measuring part of the tunnel together with the instrumentation is located in its central parts. The tested system and its surroundings is mounted on a turntable (with the scales to measure the aerodynamic forces) allowing the change of the direction of factor flowing into it. The "working" factor is the air, movement of which is forced by axial fans located downstream of the tunnel in order to obtain average speed within the range of 5-20m/s. At the inlet of the tunnel there is a fabric filter and a grid system as well as other elements stabilizing the flow. Typical scales of models of large buildings are in the range 1:200 to 1:500. Experimental model analysis as opposed to real facility testing allows the isolation of the studied phenomena from interfering influences. Test cycles can be repeated under controlled laboratory conditions. By using increasingly sophisticated techniques and sensors such as thermal anemometer, laser anemometer or visualization techniques, values, which are impossible to determine in research on real objects, may be obtained. Wind tunnels can provide test conditions which are both well-defined and possible to control, but they do not include all of ground-level atmospheric characteristics. Research is also conducted on real objects in order to obtain data on wind loads and to determine the atmospheric wind characteristics, necessary for the proper simulation of natural wind. The results of experimental studies are also a good material to verify the developed numerical modelling methods. In addition, numerical modelling methods (CFD) have recently become a significant tool supporting the development of the aerodynamics of the environment. Their use in solving problems of wind-engineering and of aerodynamics of structures are referred to as computational

wind engineering (CWE). The review of CWE methods presented in the work of Mochida and Lun [6] shows their significant development as a tool in the analysis of environmental design.

The use of experimental and numerical modelling methods of air flow enables the determination of wind conditions in the existing system of a built-up zone, as well as to predict the changes caused by modernization.

2.1. Research subject and method

The subject of the analysis is a tandem configuration of objects, which is schematically shown in Figure 3. It shows the basic relations of geometric parameters of objects and defines the coordinate system. Dimension S is the distance between the elements. Parameter S/B=1.5 – 3.0 in the study (where B is the length of the edge of the object). The height of the buildings remained unchanged, as described by parameter H1/H2=0.6.

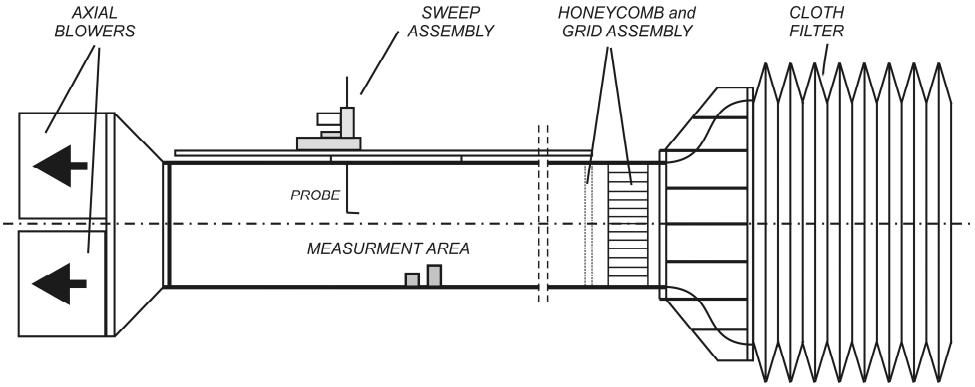


Fig. 2. A typical configuration of the wind tunnel with an open circuit used in the analysis of a number of wind engineering issues.

The considered case refers to the flow of air from the lower object, which results in the occurrence of the so-called "down-wash" effect. The phenomenon, in which large masses of air run down along the front wall of the leeward building, results in a strong circulation of air in the space between the objects.

The geometry of the system was chosen on data presented in [7], which indicates that the analysed case as a common architectural problem, causing extremely adverse wind effects. The results of the surface oil visualization were compared with the distributions of average speed in the

modelled area between the buildings which were obtained in numerical simulations.

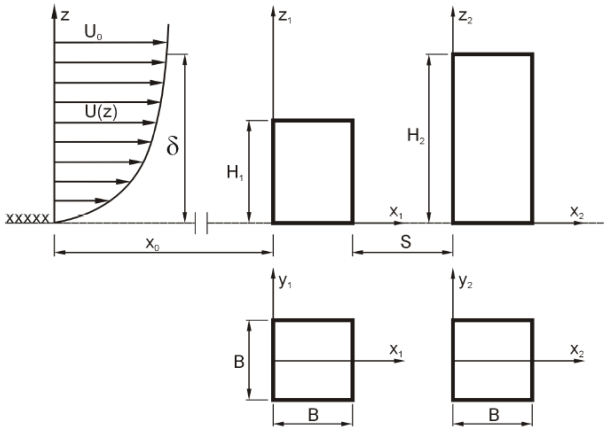


Fig. 3. Diagram of the considered configuration of objects in a tandem system

Air flow in the scale of a housing estate or simple building structures is a very complex phenomenon. Factors that affect the direction and the speed of air streams are as follows: arrangement of buildings, their size, and surface characteristics or turbulence. The arrangement of buildings can increase the speed or turbulence of the airflow, thus resulting in adverse effects, such as discomfort, wind, spread of pollution, or heat loss in buildings. At the same time, buildings may form, in certain situations, a barrier for the flowing air, causing problems with ventilation in built-up areas. The distance between adjacent buildings is one of the main parameters to be taken into consideration. Figure 4 shows how this parameter affects the shape of the flow. It presents the change in pressure distribution when a subsequent building is put in the aerodynamic trace of wind of the former building. We can observe that a too small distance between the objects causes the occurrence of a substantial vacuum in the area between the buildings.

As the space between the buildings increases, the flow begins to level off, as a result the situation resembles the one at the front of the first building.

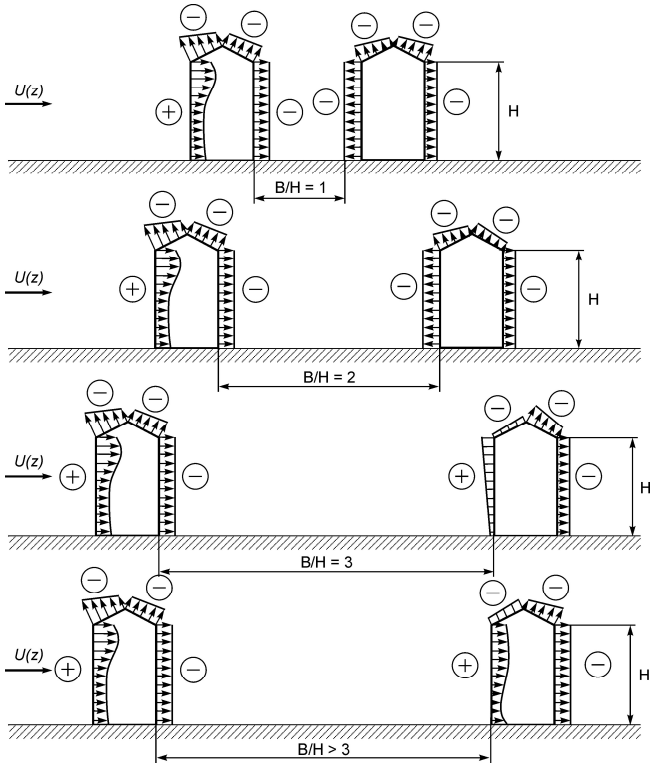


Fig. 4. The distribution of static pressure on the surface of objects as a function of the distance between them.

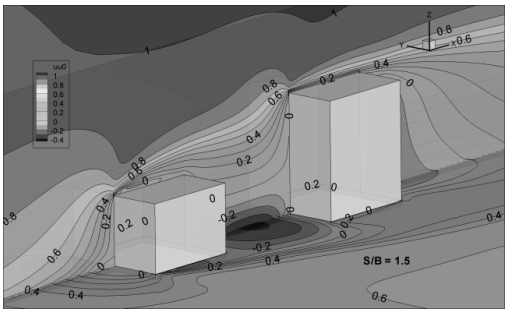
2.2. Examples of modelling methods application

To illustrate the usefulness of these modelling methods, the numerical results and the experimental measurements for the tested configuration of objects are presented below. Figure 5 presents the velocity distribution in the form of U/U0 (where U0 is the average velocity in the flow undisturbed by the presence of objects). Basing on the presented visualization of the velocity distribution in the space between the buildings, we can confirm the occurrence of the so-called. downwash effect. In these places, the air accelerates considerably, swirls and then flows back since the space is supplied with air mass flowing along the windward wall of the leeward building. For larger spacing of buildings (Fig.5b), the area of the backflow behind the windward object is also larger, but the value of speed in this case is smaller in comparison to the first configuration (Fig. 5a). It means that the increase in the distance between buildings has a positive effect

on the flow around them. Further increase in the space between the objects (Fig. 5c) results in the reduction of disadvantageous wind conditions.

As shown in Fig. 6, demonstrating the results of the surface oil visualization, the biggest changes in the flow field are also observed in the space between objects, and in the immediate vicinity of the buildings. The surface oil visualization technique is considered a helpful experimental tool used in the detection of specific zones of wind flow around obstacles erected on the ground, and thus the location of the areas of low wind zones and the ones characterised with the increased speed of wind.

a)



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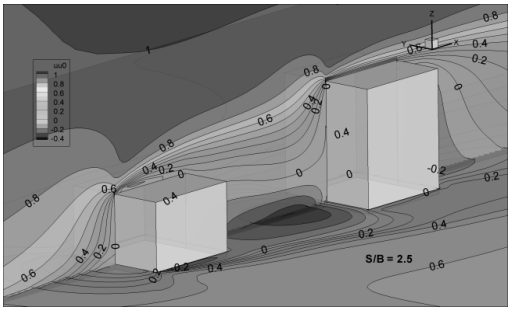

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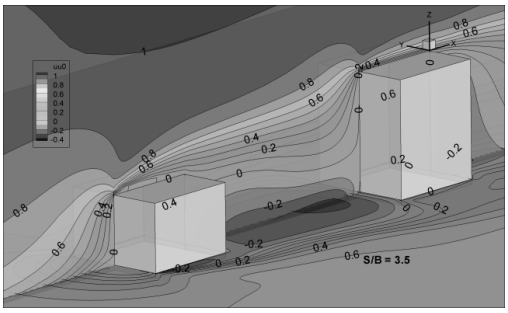
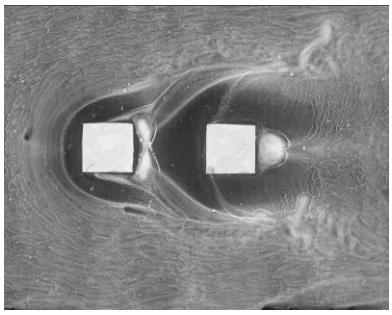


Fig. 5. Contour plot of the velocity distribution U/U0 in the objects' vicinity i.e. in planes *y/B=0* and *z/B=0*: a) *S/B* = 1.5, b) *S/B* = 2.0, c) *S/B* = 3.0

a)



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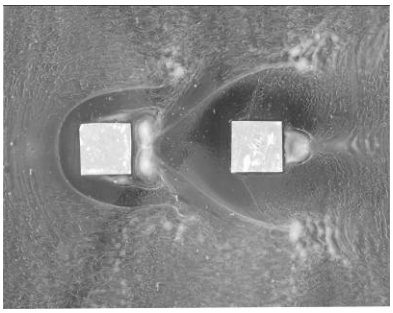

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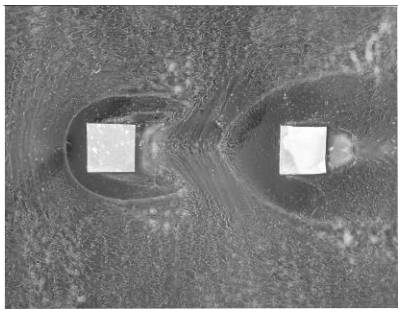

Fig. 6. The results of oil visualization of in the objects' vicinity in the tandem configuration: a) S/B = 1.5, b) S/B = 2.0, c) S/B = 3.0

Summarising, as a result of aerodynamic research, subject of which includes built-up areas, the images of velocity fields and pressure distributions on the walls of buildings are obtained. The interpretation of the findings provides answers to the questions referring to the impact of buildings on the direction and intensity of local wind conditions [4].

The knowledge is then used by architects and engineers in order to:

- realise undertakings related to designing new construction projects, revitalization projects and development of public spaces, demolition or partial demolition of buildings and structures;

- provide comfort for residents by eliminating the tiring gusts of wind near buildings, drafts and noise caused by air movement;
- anticipate, among others, the course of the dispersion of pollutants rising from factory chimneys as well as to find locations of particularly high concentrations of pollutants.

3. SUMMARY

The air flow in urban areas often causes discomfort for pedestrians, heat losses in buildings, or even damage to building structures. It is particularly important to recognise the velocity distribution of winds around the existing and designed buildings, as well as the ones subject to modernization. An integrated approach to land-use planning of the built-up areas reveals its interdisciplinary character.

Experimental model tests in wind tunnels have long been the dominant tool used to characterize the wind flow in the ground-level zone. Numerical methods for modelling of wind flows in urban areas are increasingly frequently used (tools for architects and urban planners) due to the dynamic development of mathematical models and technological progress, but in order to find optimal solutions, it is necessary to analyse a large number of flow systems dependent on the mutual configuration of buildings, their geometry and location in relation to the wind inflow [2, 5]. This enforces the use of numerical simulations coupled with optimization procedures in order to develop a computational tool to determine the position of discomfort zones as well as to optimize building conditions (zoning).

ACKNOWLEDGEMENT

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ZASTOSOWANIE METOD MODELOWYCH W PROJEKTOWANIU I MODERNIZACJI OBSZARÓW ZABUDOWANYCH

S t r e s z c z e n i e

Procesy planowana przestrzennego i modernizacji terenów zabudowanych wymagają kompleksowego połączenia zagadnień istotnych w tworzeniu zrównoważonych struktur urbanistycznych, m.in.: eko-budownictwa, klimatu wiatrowego (Aerodynamika Środowiska), zagospodarowania terenów. Eksperymentalne badania modelowe w tunelach aerodynamicznych były przez długi czas dominującym narzędziem stosowanym w celu scharakteryzowania przepływu wiatru w warstwie przyziemnej. Dzięki dynamicznemu rozwojowi technologicznemu coraz powszechniej stosowane są numeryczne metody symulacji przepływu wiatru w obszarach zabudowanych. Przedmiotem prezentowanych badań jest fragment obszaru zabudowanego składający się z układu tandem dwóch modeli budynków o różnych wysokościach charakteryzujący się występowaniem efektu „down-wash”.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

No. 9 2012

THE ASSESSMENT OF THE QUALITY OF PUBLIC SPACE ON THE EXAMPLE OF KATOWICE AND BYTOM

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Faculty of Architecture, Silesian University of Technology in Gliwice

A well-designed public space is friendly to its users. There are several different research methods to evaluate its utility quality. This study analyses town market squares in Katowice and Bytom, and two commercial complexes in these cities: SCC in Katowice and Agora in Bytom (both include representative-public squares in their concepts). First, their essential compositional-spatial features have been presented, then their dominant functions have been determined and eventually the quality of land use has been analysed (according to Hall's concept) as well as the potential of the presented spaces (PPS method).

Keywords: public space, quality assessment, PPS method, Hall's concept, Katowice, Bytom, market, shopping centre

1. INTRODUCTION

Recently, dr. eng. architect Joanna Serdyńska and I have been investigating the quality of public space, on examples of squares in Katowice. They resulted in the following elaborations:
[1] *Place Katowic wobec redefinicji funkcji przestrzeni publicznej współczesnego miasta.* (2005r) – elaborated in cooperation with dr eng. arch. Zbyszko Bujniewicz.
Town squares were analysed in terms of their urban structure.
[2] *Place Katowic – próba usystematyzowania ich funkcji w mieście*. (2008r)
The elaboration was an attempt to systematize the squares of Katowice in terms of their dominant function. For the purposes of this elaboration the following functions were assumed:

- public
- sacred

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- trade
- representative
- communicational
- recreational

[3] *Place Katowic – przestrzeń publiczna czy odspołeczna*. (2009r)
Pro-social space (acc. to E. Hall's) *„Sposób zorganizowania przestrzeni wpływa na kondycję psychiczną przebywających w niej ludzi."*
The evaluated properties are:[5]

- space closure
- scale and proportions of spaces
- lighting
- ordering of spaces
- "furnishing"
- colour of urban interior
- individualisation of spaces
- distracting elements

[4] *Place Katowic w świetle metody PPS (Project for Public Spaces).* (2011r)
While elaborating the revitalisation strategy, it is essential to observe the place systematically, and to collect the feedback from their users. The following parameters are defined as four basic components: [6]

- functionality
- social value
- comfort and image
- accessibility

The methodology and conclusions of these studies were used as a basis to compare the quality of main public spaces in Katowice (market and SCC shopping centre situated on the grounds of former Kleofas mine) and Bytom (market and Agora- shopping centre in Kościuszki Square – as both of them declared possessing representative-public squares).

2. PRESENTATION OF THE COMPARED SPACES

2.1. Market in Katowice

Rynek (Market Square) together with streets leading to it: Warszawska, Teatralna, Dyrekcyjna, Staromiejska, Dworcowa, św. Jan, Pocztowa, Wawelska, 3 Maja, Stawowa, A. Mielęckiego, Starowiejska, as well as with the beginning of A. Mickiewicza Street and W. Korfantego Avenue, form one functional-architectural unit. There are many historic dwelling houses. There are prohibitions or restrictions on admission for cars to Rynek and most of the

streets mentioned above. The bed of the Rawa River runs under the square. In its vicinity there is Obrońców Katowic Square with Pomnik Harcerzy Września, a monument commemorating scouts from the September. [8]

Rynek A – the space of the square is poorly defined. Its main facility is the Stanisław Wyspiański Theatre, located on its eastern side. The western side is occupied by department store Dom Handlowy Skarbek. The north-western side of Rynek A is adjacent to Obrońców Katowic Square, its southern side – to Rynek B. Tram tracks with stops are located within the market, which makes the space impossible to be used as a walking passage for pedestrians. There are also bus stops as well as the railway station in its immediate vicinity. Rynek 1 is approached from the north by one of the main roads of the city centre, Korfantego Avenue.

Rynek B - is closed by the surrounding buildings along its three sides: the eastern side is adjacent to department store Dom Handlowy Zenit, the southern side – to a 6-storey building providing services on the ground floor, the western side – Dom Prasy with a café, Town Office and a bank, and from the north it is directly adjacent to Rynek A. In the square's space there are flower and vegetable stalls in the arcade of the department store. Until the 90s of the previous century, Rynek (together with streets 3-Maja and Staromiejska) was the commercial centre of the town.

Fig. 1. Market in Katowice

Fig. 2. Market in Katowice, a postcard from 1908

Fig. 3. Market A …

Fig. 4. … and Market B

Fig. 5. Works aiming at Rynek's redevelopment have been commenced recently, and they are planned to be finished by 2015.

2.2. Rynek (Market Square) in Bytom

The market was built in the Middle Ages, but today it does not resemble its original form. Originally, the market was in the shape of a square, now it clearly resembles a rectangle. The revitalization of Rynek carried out in 1998r included both the market area limited with the existing buildings and the surrounding buildings. At the moment, it is a modern town square, providing people with a space that, through its formation, promotes various activities or small cultural events, and which is a place of relaxation for both the town dwellers and tourists. During the reconstruction of the Market Square's board, the orthogonal division of the square was maintained, dividing it into a functional zone and a commercial zone that combines elements of the trade and services, as well as a central zone, actually the most static part of the square, underlined with a lighting system. The most important design assumption was to obtain the feeling of the unification of the spaces while visiting the market (Rynek), despite its three-functional division.

In the central part of the Market (Rynek) a fountain with varying compositions of water figures were performed. The Market (Rynek) was lit by a basic lighting system, additionally, its board was illuminated by spot lighting, and also the fountain and trees were illuminated by separate lighting systems. A Middle Aged well, discovered in the eastern part of the market's board, was exposed. The outlines of the original Market Square (Rynek) and the Town Hall were shown on the surface of the market's board, as well as a commemorative plaque was issued. Two complexes had some trees planted: the south-west part - hybrid planes, the south-east Norway maples. [9]

Fig. 6. Rynek (Market) in Bytom.

Fig. 7. Rynek (Market) in Bytom, postcard from 1910.

Fig. 8. Bytom Rynek (Market) before…

Fig. 9 … and after modernisation.

2.3. Silesia City Center (SCC) in Katowice

Shopping Centre Silesia City Center was built in 2005 on the grounds of the former mine "Gottwald", Chorzowska Street. The architectural design of SCC assumed the restoration of the historical buildings of the old mine and the transformation of their functionality. It intended to create a modern facility, which was expected to meet the requirements of a large conurbation – a bustling city centre. The SCC has been designed as a miniature city with a number of streets (e.g. Zabrska, Sosnowiecka, Będzińska) and squares (e.g. Tropikalny (Tropical), Zimowy (Winter), Muzyków (Musicians), Poetów (Poets)) to create a specific ambience. The hall of the restored historic building hosts exhibitions, concerts, fashion shows, games for children, contests, youth happenings, and even performances of movement and mime theatres. Whereas, the former bath provides room for "art market" i.e. a gallery. Also a place of prayer was arranged - the hoist building was transformed into the chapel of St. Barbara, the patron saint of miners. A blue shaft tower of St. George of the former Gottwald mine dominates over SCC. It offers a panoramic view of Katowice. [10]

As a result of the expansion, which was carried out from October 2010 to October 2011, the complex was increased by more than 30% and thus SCC has become one of the largest of its kind in Poland. The total area of the building is 100tys.m², of which the commercial space occupies 85tys.m². There is a shopping mall with 300 shops (Tesco as the biggest one), banks, a post office or a chemist's, and also a leisure centre: 11 comfortable multi-screen cinemas and numerous pubs and cafés. SCC is provided with a parking for three thousand cars. According to the investor (Immofinanz Group), the centre is able to host 15 million customers a year. [10]

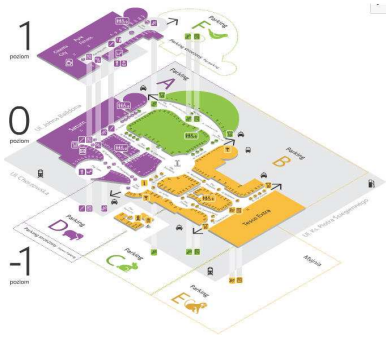

Fig. 10. Functional arrangement of SCC complex.

Fig. 11. SCC in Katowice.

Fig. 12. SCC, view from Chorzowska Street…

Fig. 13. … and onto the newly built extension.

2.4. Agora in Bytom

The modern shopping and leisure centre Agora in Bytom (put to use on 15.11.2010 r.) was built in place of the demolished in 1979 representational quarter of dwelling houses between the following streets: Jainty, Dzieci Lwowskich, Piekarska (at the crossing of three axes of the town: the commercial

one, the cultural and the park ones) and T. Kościuszki Square thus forming the city centre. Shopping centre is located at the mouth of Dworcowa Street, the main shopping street of Bytom. The south wall of the complex constitutes the northern frontage of the square, thus restoring its original dimensions before the demolition in 1979, and referring to Bytom's historical spatial structure, with houses built in quarters. Kosciuszko Square is situated in front of Agora. After its extensive revitalization, it has become an attractive complement to the gallery passages and atria designed in the centre. Its newly designed arrangements intended to restore its historical form and meaning. This square houses cafés gardens, benches shaded by trees, and the main attraction was a fountain of water with an interesting program of shows. [11]

The solid of the gallery was divided into three blocks connected with internal passages, which meet in roofed, glazed atria. The four floors of the gallery, with the total floor space of 55,000 m², house 120 shops and service points, multi-screen cinema, numerous cafés and restaurants as well as an intimate auditorium and office spaces. An internal public space was also planned: visitors can benefit from the central square, and there is a square with benches, a fountain and planted vegetation in front of the gallery. In two huge atria, the visitors may admire modern sculptures and monuments and items extracted from Kosciuszko Square during the archaeological excavations. The investor (Scandinavian company Braaten + Pedersen plus Partners) wanted the place to be a popular meeting place for the residents of the city and its surrounding areas. [11]

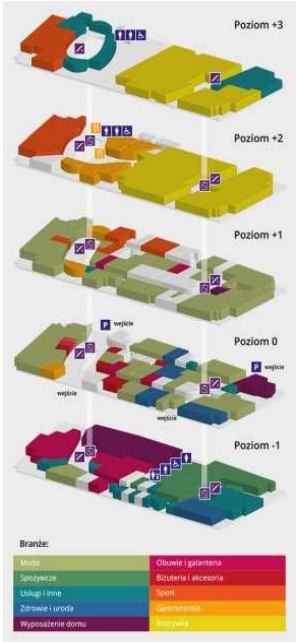

Fig. 14. Agora's functional scheme

Fig. 15. Agora in Bytom

Fig. 16. Kościuszki Square before…

Fig. 17. … and after the modernisation

2.4.1. The analysis of the compared spaces

The tables below present: the procedure of selecting the dominant function of the considered public spaces, their evaluation according to the Hall's concepts (their pro- or anti- -social character), and according to PPS method (Project for Public Spaces).

Tab. 1. Evaluation of the dominant function (from 0 to 5):	Katowice		Bytom	
	Rynek	SCC	Rynek	Agora
• Public function	3	3	5	2
• Sacred function	0	1	0	0
• Commercial function	3	5	3	5
• Representational function	1	3	5	0
• Recreational function	0	2	4	1
• Transport function	4	0	1	0
Dominant function	transport	commer cial	repr.+ publ.	commer cial

Tab.2. Evaluation of the space – is it pro- or anti- social acc. to Hall's concept (from 1 to +1):	Katowice		Bytom	
	Rynek	SCC	Rynek	Agora
• Space closure	-1	+1	+1	+1
• Scale and proportions of the space	0	+1	+1	0
• Lighting	0	+1	+1	+1
• Space arrangement	-1	+1	+1	0
• “furnishing”	-1	+1	+1	+1
• Colour of the urban interior	0	0	+1	0
• Space individualisation	+1	+1	+1	+1
• Lack of distracting elements	-1	+1	0	0
Final note:	-3/8	+7/8	+7/8	+4/8

Tab.3. Evaluation acc. to PPS method (from -2 to +2):	Katowice		Bytom	
	Rynek	SCC	Rynek	Agora
Functionality:	+1	+6	+7	0
• the presence of the users	+1	+2	+2	0
• age diversity	+2	+1	+2	+1
• variety of services	0	+2	+1	+1
• use of space	-2	+1	+2	-2
Social value:	+2	+5	+7	0
• the presence of groups of users	+1	+2	+2	-1
• social interactions	+1	+1	+2	0
• diversity of users	+2	+2	+2	+1
• order maintained by the users	-2	0	+1	0
Comfort and image:	-1	+5	+5	+2
• comfort of seating places	-2	+2	+2	0
• cleanliness and safety	0	+2	+1	+2
• number of women/number of men	0	0	0	0
• visual attractiveness	+1	+1	+2	0
Transport accessibility:	+7	+5	+6	+2
• visibility from the outside	+1	+2	+2	+2
• lack of obstacles in accessing,	+2	0	+2	0
• convenient neighbourhood	+2	+2	+2	0
• public transport accessibility	+2	+1	0	0
Total note:	+9/32	+21/32	+25/32	+4/32

3. CONCLUSIONS

The market of the town should be the city's representative picture. It should provide the public space which would be deeply embedded in the context of the place (the existing buildings and historic arrangements), corresponding to the modern needs of residents and tourists. Table 1 shows that the expectations were met in the case of Rynek in Bytom, revealing at the same time the pathology of Katowicki Rynek, which currently serves solely as a transportation junction. The need for its reconstruction has been an urgent problem for years, as well as the subject of contests and public discussion.

The analysed shopping centres differ in their location – Katowice shopping centre, unlike the one in Bytom, is located outside the city centre. Both of them, to varying degrees, are trying to meet the consumers' expectations. In addition to purely commercial functions, they also weave features of a different type.

Table 2 shows the development of the site, while Table 3 - its potential, hence the discrepancies appearing in the assessment. In paper [4] three situations were separated:

1. When the assessment of the development is negative, and evaluation of the potential is positive, this means that the place is "underinvested" or invested adversely to its potential.
2. When the assessment of the development is positive, or equals 0, and the assessment of the potential is negative – the place is “overinvested”, i.e. possible occurrence of a certain malfunction.
3. When both ratings are positive – that means that the development is compatible with potential and the funds for the realization of the square are properly spent.

Comparing these two assessments, both Rynek in Bytom (+7/8 and +25/32) and SCC in Katowice (+7/8 and +21/32) reveal that their developments are in line with their potentials. Bytomski Rynek (market) is an attractive public space popular with their residents and visitors. SCC with its clear spatial arrangement modelled on a city centre, with streets and squares of various nature and functions, shielded against the discomfort of atmospheric conditions. The first note Rynek in Katowice received was negative (-3/8), though the second note was positive (+9/32). This shows that the place is clearly "underinvested". Let us hope that after its conversion, both the first and the second note will improve.

Agora in Bytom may be considered as an “overinvested' place. Although the second note (4/32) is not negative, compared with the potential note (4/8) it is rather low. Comparing it to the SCC, despite the declared functional similarities, the note 1 for Agora is lower. It seems to be due to mainly the organization of space, which is much more readable, logical and orderly, if compared to the Katowice implementation.

In previous studies [1], [2], [3], [4] only squares were evaluated. This study shows that the criteria adopted for the assessment can also be used in the realisation of building constructions (in this case commercial centres) that weave functions of public spaces in their program assumptions.

These findings may provide a valuable source of information when making future modernization or revitalization efforts of the analysed above public spaces, as well as a point to consider while designing squares and other facilities of a public character, so that they were planned in accordance with their potentials.

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OCENA JAKOŚCI PRZESTRZENI PUBLICZNEJ NA PRZYKŁADZIE KATOWIC I BYTOMIA

S t r e s z c z e n i e

Przestrzeń publiczna dobrze zaprojektowana jest przyjazna dla jej użytkowników. Istnieje szereg różnych metod badawczych, dzięki którym można ocenić ich jakość użytkową. W niniejszym opracowaniu poddano ocenie Rynek w Katowicach i w Bytomiu, oraz dwa kompleksy handlowe w tych miastach: katowickie SCC i bytomską Agorę (oba deklarujące w swym koncepcjach posiadanie placy o charakterze reprezentacyjno-publicznym). Po przedstawieniu ich zasadniczych cech kompozycyjno-przestrzennych, określono dominującą funkcję, przebadano jakość zagospodarowania (według koncepcji Halla) oraz potencjał tkwiący w prezentowanych przestrzeniach (metoda PPS). Dzięki tej analizie można oszacować czy analizowane przestrzenie publiczne zrealizowane zostały zgodnie ze swym potencjale, niedoinwestowane, czy też przeinwestowane. Wnioski stanowić mogą cenne źródło informacji przy podejmowaniu w przyszłości ewentualnych działań modernizacyjnych czy rewitalizacyjnych dla nich samych jak i punktem do zastanowienia się przy projektowaniu innych placy i obiektów o charakterze publicznym, tak by planowane były zgodnie z potencjałem ich wykorzystania.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

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COMPOSITION OF A PLAN OF AN ARCHITECTURAL COMPLEX

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It may be proved that the space should be composed in a certain and not other manner for specific needs and objectives so that its form was not accidental. The composition is a very important part of creation - the knowledge of its rules (following them or their intentional violation) conditions the success of each project. Despite its significant role, it is often marginalized and regarded as a set of rigid rules, dead rules. In this paper, I will try to prove that it is a false belief and the knowledge of the theory is the key to the conscious application of various elements of spatial composition and helps in the process of creation. In the first part of this series we will deal with the elementary rules - with the issues of composition of urban planning.

Keywords: plane composition, plane surface, principle, rule, design

1. VOCABULARY

The elaboration refers to architecture, urban space, in which the man moves around, and the vocabulary of its composition is not completely defined. It is necessary, therefore, to clarify the scope and scale of the spatial system which will be analysed.

2. OBJECT, SURROUNDINGS AND OBSERVER

It is essential in this case to state that every object is somehow composed and as such it influences its surroundings visually after it has been introduced into it. What is the impact and how to understand the concept of surroundings? Most generally, a building object, a part of space of the physical environment constituting its surroundings, and an observer compose three main elements of the system in which the visual perception process takes place.

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Both the object and its surroundings are characterised by a series of physical features which may be perceived visually such as shape, size, colour, texture, proportion, transparency, space, articulation, decoration and other. In terms of composition, the features take the form of points, lines and planes that are component parts of the plan compositions. This set of features is referred to as the visual character.

The observer is a designer, creator and in this sense - the user of the space. The observer has the potentials to embrace the whole space with just one glance. Looking at a building object together with its surroundings, it is clearly possible to see and evaluate the structure of the arrangement of other objects and communication systems around. Attention is paid to architectural elements.

Any types of obstacles around the observer who halts at a certain point, create a kind of "interior", regardless of the absolute sizes of the perceived pitch of the surroundings. The spatial interiors may be of various types - organized or random, large or small, natural or man-made. Dimensions of each interior can be specified on a two-dimensional plan, which allows precise analysis of their forms. Situations in space, in an urban space particularly, repeat due to the occurrence of similar restrictions.

3. PLANE SURFACES

The considerations of composition are rooted in topics discussed by W. Kandinsky, and presented in details in the book “Point, line, plane”. “Its content can be, more or less accurately transposed into the means of expression of other artistic disciplines” says the theorist [1]. Personally, I think that the Kandinsky's theory should be the starting point for any deliberations on the plane construction. Having read it, it is hard to disagree with this opinion, therefore it will be discussed in its basic form at this point. First of all, W. Kandinsky says that every artist feels “living breath” of the image before starting their work, and that there is “something of the crime” in fraudulent breach of the surface. The plane of the picture is understood in terms of a material surface which is a substrate surface of the image content. “Everything which is not necessary for the expression of the picture content, i.e. anything which would interfere with its reception, the artist has to remove from the picture frames”. “Such selected elements of composition should be arranged in such a way that the composition should fill the surface of the picture well and it should be completely enclosed within the picture frames” [2]. For the architectural considerations the term **plane surface** (PP), (similar to the picture surface (PO) by W. Kandinsky) referring to material and simultaneously abstract basis for its content. A totally objective arrangement of the elements on the plane, i.e. a completely objective PP can not be understood arbitrarily. Absolute objectivity can not be achieved.

It is extremely essential to understand that the nature of the PP, i.e. its shape and boundaries, is independent of the designer's possibilities. In practice, we cannot influence it. We must distinguish between the schematic PO and the dimension diversity of the PP in reality. This fact is a source of immense possibilities of composition.

4. BOUNDARIES OF PLANE SURFACES

The plane surface PP is limited with "frames" - the external **boundaries (GP)** of the plane surface, which is a closed system consisting of, e.g., two horizontal lines and two vertical lines which form polygons, broken lines or curves, etc. that define it as a composition independent of the environment (Fig. 1).

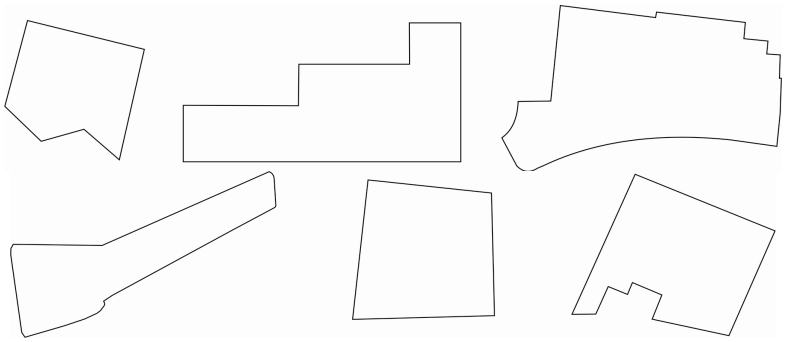

Fig. 1. Examples of plane surfaces PP and their boundaries GP

A broken line representing the nucleus of the plane boundaries, consists of two sections and an angle. The right angle is constant in magnitude, it only changes the direction. In the case of the most regular structure, it forms a square. The simplest broken line may be complicated by attaching to it a few other lines. As a result, broken lines forming polygonal boundaries, from the simplest to the most complex, may be formed as a result of all sorts of combinations. They may be a combination of obtuse angles with equal arms, may consist of obtuse and acute angles with equal or unequal arms, obtuse, acute or right angles, etc. The more the length of the individual sections of a broken line vary, the more complicated boundary lines are formed. Inexhaustible diversity of forms of the boundary lines is owed to arches, which never lose a kind of relationship with a wheel, no matter how distant, since they convey its characteristic features and tensions. However, the boundaries are not just lines, which "frame" the plane surface. The boundaries are primarily the surface limits within which the designer has to put everything that he needs to express the content of the project.

In the art sciences, we often hear the sentence that an image is a slice of nature enclosed in the frame", just as a reflection is in a mirror, which we set on

an object. However, everyone understands that the section can not be a piece of nature cut out from the world around us thoughtlessly and without any deliberate selection.

It is one of the basic conditions for each composition, and not just image composition, since this is not only a painted image, but each composition that has its own "frames" in which it has to "fit". A slogan is typed in the banner frame, seasonal decorations may be framed with the edges of the walls, the exhibition of books is framed with the cabinet, the architectural frames of a building are the frames of the plan view, and in an urban environment - the boundaries of the land plot (Fig. 2) etc. Regardless of the type of composition and the shape of a frame, the general principles for composition shaping in a limited framework will always be the same [3].

5. WHAT IS A COMPOSITION OF PLANE SURFACES?

A two-dimensional plan may contain the "leaven" of spatial qualities or can prevent their formation. Looking at a two-dimensional plan which determines the land disposition and its basic division, it is possible to trace the opportunities it will present for the formation of the third dimension, which in the eye of the observer will transform itself into the walls of houses, streets and square. However, the plan is not the only basis. Similar plans may provide the base for different architectural complexes. In the architectural scale, in the scale of an interior even if it is complex and merges with other interiors, the basic elements of composition are any urban forms on the plane surface. What is the composition of the drawn plane? Putting it as simple as possible: it is the set of forms on the image surface forming the closed entity. Then the question of the principle of this system may be raised. The answer is: it is the arrangement of forms counterbalancing each other.

Everyone understands, what “arrangement of forms” means, since everybody is endowed with some kind of sense of order, which allows them to arrange the furniture in their rooms or objects on their tables in an “aesthetic” manner.

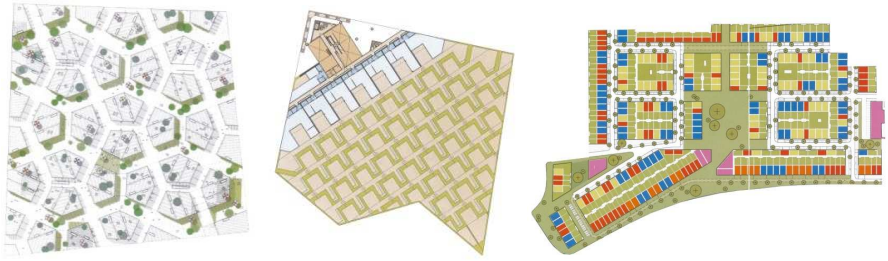

Fig. 2. Examples of functional plans on the surface of the PP plan.

However, in the case of the so-called plane surface, this is not the matter of usual order of objects in terms of everyday dimension. It is the matter of arranging the forms on the plane with respect to the rules of abstract perception, which govern in the particular plane. The concept of **balance** is the most essential for a good and harmonious composition. Equilibrium (a Latin word for "balance") is almost synonymous with the concept of good composition. In the evaluation process, which is applied to any work, the presence or absence of the equilibrium in the image is the criterion equally important as other criteria such as: the colour selection criterion (deliberate and interesting colours), well-drawn shapes, interestingly solved spaces, etc. Balance is a state of "reconciliation" between conflicting forces which wrestle with each other in the composition. R. Arnheim [4] writes: "In a balanced composition, all the factors, such as the shape, direction, location, determine each other so much that no change seems possible, and the entity receives the nature of a necessity, in all its parts." When the composition does not reveal signs of support for the forces balancing each other, it "becomes incomprehensible", and the work seems accidental, and therefore unsatisfactory. The forces need to be determined and then the concept of balance will become almost obvious in the process of image creation [1].

6. BASIC PRINCIPLES OF PLAN COMPOSITION

There is a number of principles that govern the relations between the forms created in the space and the man's experience. If the relations are proven, it will be possible to draw conclusions from these observations to consciously create similar and derivative relationships, and to apply such solutions in urban composition to act on an observer in the manner intended by the designer evoking feelings, moods and tension according to the need and function of the spatial system. Numerous elements of the urban composition are simple, well-known and almost obvious phenomena, resulting from equally simple rules and geometric structures.

- The principle of equilibrium [f], which upholds the order on the plane, prevents the forms from chaotic arrangements. The balance on the plane is like scales, weights of which are the forms differing in sizes and the "weight" of the function.
- The principle of symmetry which allows obtaining a perfectly balanced composition, i.e. such composition which parts on either side of the axis are the same or very similar.
- Principle of rhythm is the repetition of certain phenomena or forms at regular intervals on the plane.

The rhythm of the urban composition is the repetition of the same or similar spatial elements, if the shapes and dimensions interact with each other harmoniously. It may also be the result of deliberate calculation, which combine the size with the directions of the line.

7. TYPES OF PLANE COMPOSITIONS

Majority of the literature elaborations, basing on the arrangement of elements, mention types of compositions which are opposite to each other, in which opposing tendencies collide. The semantic contrast is even enhanced when they are put in pairs. The type is determined on the basis of "all or nothing". If the circumstances indicated by the type occur, they are either important and so force to accept the resulting judgement, or not. Out of two opposing compositions, one must be invalid.

The most common definition of the composition nature is the definition: **static or dynamic.** A static composition we may name the one which has a strong base, which has the advantage of horizontal lines and especially vertical ones where the weights are evenly distributed (Figure 2.).
"Compositions of that kind are formed just like a bridge, or a house: it can possess some diagonal and curved lines, but the whole unit has to be well embedded ..." [3]. Static composition is usually stretched on some geometrical figure - circle, triangle, rectangle - readable for the viewer at first sight. It can be built on the axis of symmetry, but not necessarily. There are no diagonal elements in the composition, since any deviations from vertical or horizontal directions are perceived by the human eye as a movement. In past centuries, it was a favourite composition of planes, the contents of which corresponded to the overall system. The opposite to it that is, a dynamic composition - has a multiplicity of directions, usually diagonal - giving the impression of movement (Fig. 2).

In the dynamic composition, the system is "exploded" from inside by an invisible force that makes you feel a kind of aesthetic concern. There is another type of classification - another pair of opposing systems of composition: **closed** and **open**.

A closed composition is - as the name suggests – a system of forms organized in an inseparable whole. It must not be changed, since there is a concern that it will scatter. In this composition, every square inch is justified and subordinated to the whole (Fig. 3). An open composition is an option in which some space is left for the recipient to interpret.

Fig. 3. An example of a composition of a closed plane and its relation with a three-dimensional space. Tatiana Bilbao/mx.a. Guadalajara. Mexico 2006-2010.

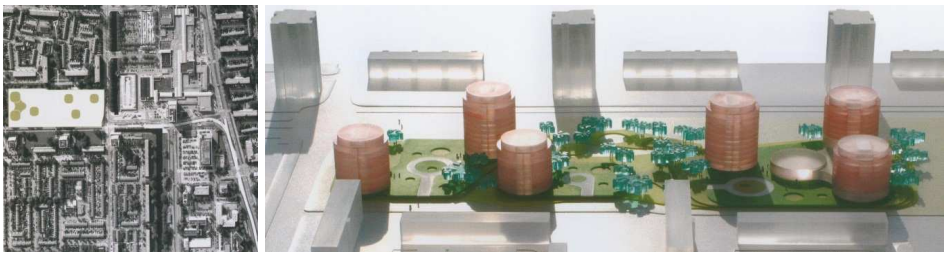

Fig. 4. An example of a composition of an open plane. VMX Architects. Schalkwijk, Haarlem. Holland 2006-2010.

An open plane composition may include a plane which was thought to be based on a single central axis – e.g. horizontal. The horizontal element may constitute a communication axis around which minor horizontal, vertical or oblique elements “are organised” symmetrically. Such a composition is called “open” since it may be (in a limited way) supplied with new elements, and its format may be even increased (expanded) on the sides (fig. 4.).

In short, a walkway that runs with a repeated pattern, a space that has no end, a fragment of a forest, lawn, which goes further somewhere else, these all are open compositions. The third pair of opposing compositions are systems that have a central point (dominance) and the ones which are deprived of one. Compositions without a dominance assume that each fragment of the image is equally important. It is absolutely balanced with divisions and no part of the plane is more important than other. A composition that has a dominance (or a composition with an accent e.g. elliptic or circular), is such an arrangement of the plane where some part is particularly highlighted – with a dominance, or with an element which stands out for its special form [5]. The fourth pair of opposing composition is a geometric composition or an unrestricted one. The geometric composition is based on the mutual relations of the shape. A geometric composition will be called such, where the perceived elements are connected with lines, circles, and other geometric figures. An unrestricted composition carries the impression of random location of its elements . Mutual relation are not strong.

We will deal with an unrestricted composition where the system of forms is deprived of any overriding hierarchy, and will constitute a chaotic structure.

8. PRINCIPLE, RULE; SUPPORT OR IMPEDIMENT?

About the rules, or if preferred architectural composition rules, many treaties and books have been written throughout the centuries. Some of them gave a precise indications of proportions of cornices columns and capitals, how to divide elevations where to place window and door openings, while others, minutely examining the function of each building, taught how to design post offices, railway stations or schools. In the design compositions there is a difference between a rule and a principle. Although, precise definitions of the words “rule” and “principle” are extremely difficult to formulate. And any of the cited bibliography does not contain definitions of these terms. Some authors explicitly state that formulating a commonly accepted definition is not possible (hence various people understand these terms differently), while others take the implicit assumption that these concepts are familiar to anyone and thus differentiated intuitively. It seems that the distinction between the rules-based and principles-based composition standards is not well defined and can be interpreted in different ways.

The rule indicates how something is to be done, formalizes the operation. For example, the division of important elements into equal parts, lines that cross at the same point, static system of construction, the balance of horizontal and vertical directions, etc. The composition follows clear and precise records.

Rules remind us, what to pay attention to and help us to prepare the ground for what can develop into a valuable work. They are to be followed in order to focus our attention onto what could restrain or help the composition. They were built on the basis of practical experiences that have worked for more than a thousand years, not only in architecture but also in painting, drawing, prints, and sculpture. In the process of work conception, when the creator is looking at the motif on the plane, the next step is to find the right point of view and to compose the picture elements in a closed area of the plane. The formation of a lively and close relationship between the designer and the motif is not only the general rule, but also a necessity. Any change in the plane elicits other emotions in a sensitive designer. The best composition is the one which evokes the strongest emotions. If we start to think about the rules of composition at this point, we impose an intellectual structure on our composition. If we decide to improvise basing on our sensitivity rather than compose, the same structure disturbs our lively relationship with the found motif, prevents us from looking at it and creates an unnecessary distance between us and the object to be designed. Then the structures of the composition, may only disturb not help! If we decide

that composing is intellectual, rather than sensitive and emotional. Then the elements of the plane may act not only according to what they represent, but also according to their physical properties. For example: shapes and sizes, location and orientation, form and its outlines, texture, colour and shades. Then the structures imposed on the composition allow us to understand the basic principles of using the language of forms and spatial organization and mutual relationships between a building and the environment, they only help us.

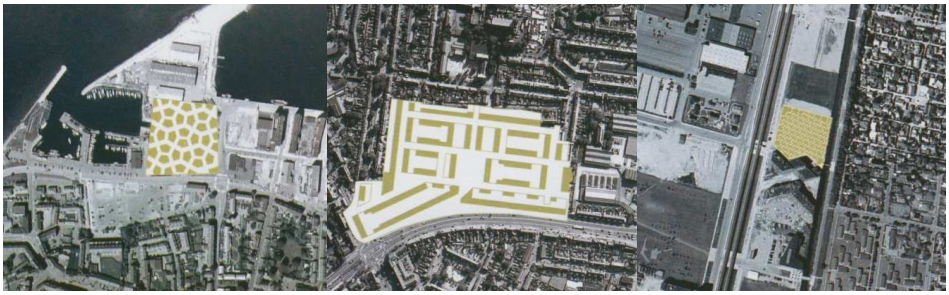

Fig. 5. Plans of designed modern architectural complexes within an existing building: a) BIG Holbaek. Denmark 2006-2010, b) FUNDC Eindhoven. Holland 2004, c) PLOT=BIG+JDS Copenhagen. Denmark 2005-2008.

The only thoughts that come to mind are: What shape is formed by the boundaries of the plane? Is the arrangement of the plane geometrical or unrestricted? Is it horizontal or vertical? What is happening in the vicinity of the plane? In practice, it is likely that we will be able to find answers to the questions by just reading the surroundings of the plane (Fig. 5).

9. SUMMARY

A plan of an architectural complex, regardless to the technique it is performed and regardless to the fact if it resembles or not the real world – must be composed in a systematic and orderly manner. There are no two plans composed equally, or even similarly, but there are some rules of composing the elements which form the image.

While composing a plane, two threads are the most important:

- Our sense of the relationship between the components of the composition of the plane. These relationships are not only emotional, but first of all physical.
- Our response to each element of the plane. The reaction which is dependent on what the element represents, and on its physical properties.

In the design practice, the use of intuition in urban composition is under the pressure of economy and construction technology all over the world and often for illusory benefits. And as much as the economic analysis and technical-economic indicators were almost brought to a baroque state, the composition, as

a factor consciously used by a designer, is applied very rarely. This is a real misfortune, since the image of the picture is always based on the compositional scheme which puts in order all the elements of the subject, even very complex. Composite diagrams are the starting point for further work [6]. However, in spite of their frequent intuitive use in urban practice, it may be frequently observed that in the cases where intuition and the sense of space fail, there is awkwardness or even major errors in the designed solutions. The understanding of the principles of the plane composition and acquiring the skills to use the elements of composition consciously, will always give answers to the question: why? Why a particular space was created, why was it given this particular shape under these particular conditions.

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KOMPOZYCJA PLANU ZESPOŁU ARCHITEKTONICZNEGO

S t r e s z c z e n i e

Można dowieść, że przestrzeń winna być komponowana tak, a nie inaczej dla określonych potrzeb i wytyczonych celów tak, aby jej forma nie była przypadkowa. Kompozycja jest niezwykle istotnym etapem tworzenia – od znajomości jej reguł (stosowania się do nich bądź świadomego ich łamania) zależy powodzenie każdego projektu. Pomimo swej niebagatelnej roli, często jest marginalizowana i uznawana za zbiór sztywnych, martwych zasad. O tym, że jest to fałszywe mniemanie, a znajomość teorii jest kluczem do świadomego stosowania różnorodnych elementów kompozycji przestrzennej i pomaga w prawdziwie twórczym procesie, postaram się dowieść w niniejszym opracowaniu. W pierwszej części tego cyklu zajmiemy się elementarnymi jej prawami - problematyką kompozycji planu urbanistycznego.

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PREDICTION OF DEFLECTION FROM FLATNESS AND A VERTICAL POSITION WITH THE USE OF NEURAL NETWORKS

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The paper presents an attempt to apply unidirectional multilayer neural networks in the prediction of the deflections from flatness and from a vertical position of building walls, on an example of periodic measurements in the church of the Blessed Virgin Mary in Toruń. The applied methods of artificial intelligence in a form of sigmoid neural networks were taught with the use of the backpropagation method, which bases on the gradient methods described in optimization theories. The prognosis of the values of the deflections from flatness and from vertical position was carried out for a single measurement epoch on the basis of ten periodic measurements performed at several-year intervals.

Keywords: neural networks, deflections from flatness, prediction

1. INTRODUCTION

Unidirectional multilayer neural networks with sigmoid activation functions (multilayer perceptron) are applied in solving numerous practical problems. They most frequently constitute a component controlling the process or a decisive part transmitting the executive signal to the elements of the devise which is not directly connected with neural networks. Neural networks perform various functions which may be presented in some basic groups: approximation and interpolation, pattern recognition and classification, compression, identification and prediction. In each of the applications, a network works as universal approximation of a function of several variables, and which realises a non-linear function:

$$\mathbf{y} = f(\mathbf{x}) \tag{1}$$

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where $\mathbf{x}$ is a input vector, whereas $\mathbf{y}$ is a realised function of several variables. As far as prediction is concerned, a neural network's task is to determine future responses of a system on the bases of the values known from the past. If the the values of input $\mathbf{x}$ are known at the moments prior to prediction $\mathbf{x}(k-1), \mathbf{x}(k-2), \ldots, \mathbf{x}(k-n)$, the network is able to estimate the value of vector $\tilde{\mathbf{x}}(k)$ in current moment k. The estimation takes place in a learning process which for a multilayer percptron is carried out with the use of the backpropagation method. During the teaching process, the net's weights are adapted, applying the current prediction error $\varepsilon = \mathbf{x}(k) - \tilde{\mathbf{x}}(k)$ as well as the value of this error at previous moments (Osowski, 2006; Rutkowski, 2006).

2. NEURAL NETWORK MODEL

Unidirectional multilayer neural networks with a bipolar activation function (multilayer prceptron) were applied to predict the deflection of a wall surface from flatness and from the vertical position. In order to realise the input – output mapping, a net of a two layer structure was applied (fig.1). The neurons of the hidden structure were stimulated by a nonlinear continuous activation function (Bishop, 1995,2006)

$$y = f\left(\mathbf{w}_i^t \mathbf{x}\right) = f(net) \qquad (i = 1,2,\ldots,n), \tag{2}$$

the domain of which is a set of total neural excitations. To solve such a defined task, a sigmoid bipolar activation function $f(net) = \tanh(\lambda net)$ was applied, where λ is a descent coefficient of the activation function. The application of the continuous activation function allows assuming the strategy for the weights selection on the basis of gradient optimisation methods. In the process of the numerical realisation, the weight correction consists in the minimisation of error function

$$E = \frac{1}{2}\sum_{j=1}^{m}\left(d_j - z_j\right)^2 \tag{3}$$

defined as a sum of squared differences between the values of input and output signals: expected d_j and current z_j (j=1,2,...,m). It should be added that neurons of the outer layer had the linear activation function (Rivas & Personnaz, 2000, 2003). For two layer networks (fig.1), output signal $\mathbf{z}$ expresses the relation written in a matrix form (Żurada i in., 1996)

$$\mathbf{z} = \Gamma[\mathbf{W}\mathbf{y}] = \Gamma[\mathbf{W}\Gamma[\mathbf{V}\mathbf{x}]] \tag{4}$$

where **W** is a matrix of weights in the output layer, **V** is a matrix of weights in the hidden layer, whereas $\mathbf{\Gamma}$ is a nonlinear operator in a form of a diagonal matrix containing the values of the activation function $f(net)$ on its main diagonal. The teaching process was carried out with the backpropagation method, utilising the gradient methods described in the optimisation theories. During the teaching process, the weights are corrected according to the relation:

$$\mathbf{w}_k(n+1) = \mathbf{w}_i(n) + \eta \mathbf{p}(n) \tag{5}$$

where n is an teaching current step, $\mathbf{p}(n)$ - minimisation direction, η - teaching coefficient

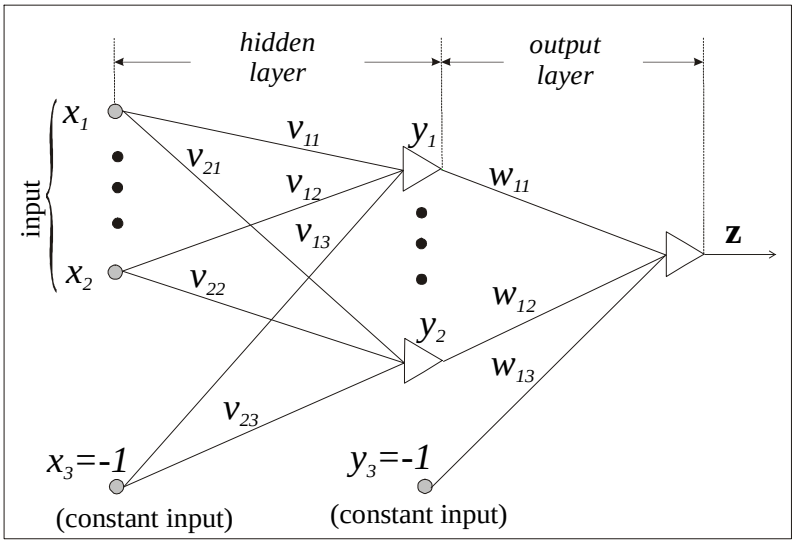

Fig. 1. The structure of a unidirectional two-layer neural network

To predict the deflection from flatness and vertical position, the following gradient methods were applied: the steepest descent method, a variable metric method, Levenberg – Marquardt's method and conjugate-gradient method (Duch i in., 2000; Osowski, 2000; Riedmiller & Braun 1992,). Table 1 presents the list of applied methods together with the determination of minimisation direction $\mathbf{p}(n)$ in subsequent iterations. An important issue occurring in the process is the selection of the criterion that causes the backpropagation algorithm to stop. It is obvious that when the minimum (local or global) is obtained, gradient vector $\mathbf{g}(\mathbf{w}(n))$ takes value 0. The algorithm was stopped, if the value of the Euclidean norm of the gradient vector fell below the target threshold, value of which was assumed at $1e^{-10}$ level.

Table. 1. List of gradient optimisation methods (Stachurski & Wierzbicki, 2001)

No.	Optimisation method	Minimisation direction $\mathbf{p}(n)$
1	The steepest descent method	$\mathbf{p}(n) = -\mathbf{g}(\mathbf{w}(n)) = -\nabla \mathbf{E}(\mathbf{w}(n))$
2	The variable metric method	$\mathbf{p}(n) = -[\mathbf{H}(\mathbf{w}(n))]^{-1}\mathbf{g}(\mathbf{w}(n))$
4	The Levenberg – Marquardt's method	$\mathbf{p}(n) = -\frac{\mathbf{g}(\mathbf{w}(n))}{v_n}$
3	The conjugate-gradient method	$\mathbf{p}(n) = -\mathbf{g}(\mathbf{w}(n)) + \beta_{n-1}\mathbf{p}_{n-1}$

The evaluation of the prediction with the use of the above mentioned gradient methods was carried out on the basis of the value of the root-mean-square error *RSME* (*Root Mean Square Error*), defined with formula

$$RMSE = \sqrt{\sum_{j=1}^{m}\left(d_j - z_j\right)^2} \tag{6}$$

3. A NUMERICAL EXAMPLE

The surfaces of the object walls undergo a technical control during their erection and their exploitation (Czaja, 1983). The example utilises the measurements of the walls of the Blessed Virgin Mary church in Toruń, which were carried out with the use of the spatial angular indentation method. The walls neighbouring Virgin Mary's Street were subjected to a particularly thorough analysis (fig. 2 and fig. 3). The church erection was commenced at the end of the 13th century, and the works lasted about 150 years. The building was repeatedly modernised, and obtained its current shape after the renovations carried out after World War II. Nowadays, the church is a three-nave, asymmetrical building with an extended presbytery 27m high and 66m long. As a result of the building and modernisation works, particularly the alterations in the roof structure from a triple-pitched roof into a double-pitched one, the church's walls displayed considerable deformations from the flatness and the vertical position, which initiated the control measurements carried out in 1977 for the first time (Niepokólczycki, 1977, 1981) and in 2011 for the last time (Nagórski 2012).

Fig. 2. Satellite picture of the Blessed Virgin Mary in Toruń

Fig. 3. A wall subjected to the measurements neighbouring Panny Marii Street.

The prognosis of deflections from the flatness and the vertical position was performed with the use of multilayer neural networks taught with the backpropagation method. The values of the estimated displacements were compared with the responding ones obtained from periodic measurements carried out in July 2011. The data constituting the teaching set consisted of the values of deflections from flatness and the vertical position obtained from ten periodic measurements taking place in 1977 – 2010, whereas the testing set consisted of the values of the deflections obtained from the measurements carried out in July 2011. To execute the task, a multilayer neural network of a 3_8_1 architecture was applied. The input vector consisted of measurement data and the time determination for particular periodic measurements. The output

vector consisted of the calculated deflections from flatness of the external walls of the church obtained in 55 monitoring points.

The values of deflections obtained in measurements and the ones predicted by the neural networks, for the earlier discussed gradient optimisation methods, were listed in Table 2. Due to the volume of the paper, table 2 depicts only the deflections for selected monitoring points. Fig. 4 presents deflections from flatness obtained with the use of neural networks (the applied optimisation method – conjugate-gradient method), whereas fig. 5 presents deflections obtained from the measurements in 2011. On the basis of the performed measurements and calculations, it can be stated that deflections from flatness and the vertical position of the wall at a height of 23 m amount over 40 cm.

Table 2. A list of deflections from vertical position obtained from the measurements and calculations.

No. of particular monitoring points	Deflections from vertical position obtained from measurements [cm]	Deflections from vertical position obtained with the use of multilayer neural networks				
		The steepest descent method [cm]	The variable metric method [cm]	The conjugate-gradient method [cm]	The Levenberg – Marquardt's method [cm]	Algorithm RPROP [cm]
1	30,9	30,5	30,8	30,9	30,6	30,7
10	7,2	7,8	7,0	7,1	7,3	7,0
20	15,9	16,3	15,9	15,8	16,1	15,8
30	32,4	32,1	32,6	32,5	32,2	32,5
40	-0,2	-0,5	-0,3	-0,2	-0,4	-0,3
50	30,3	30,8	30,4	30,3	30,6	30,4
55	0,3	0,7	0,3	0,3	0,6	0,4

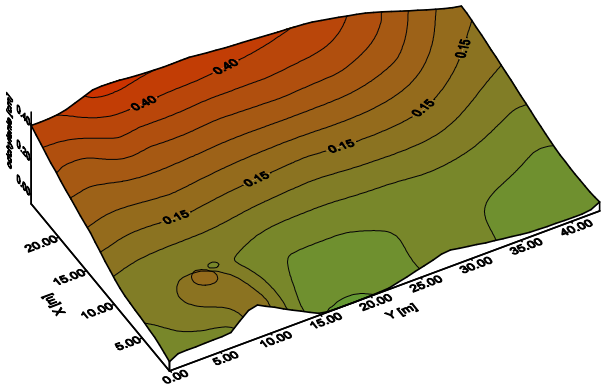

Fig. 4. Prediction of deflections of the wall obtained with the use of neural networks

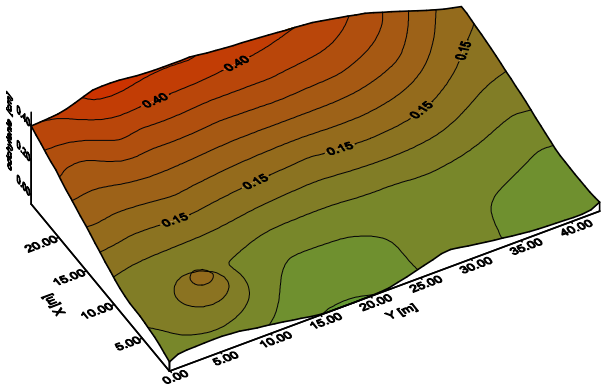

Fig. 5. Deflections of the wall obtained from measurements

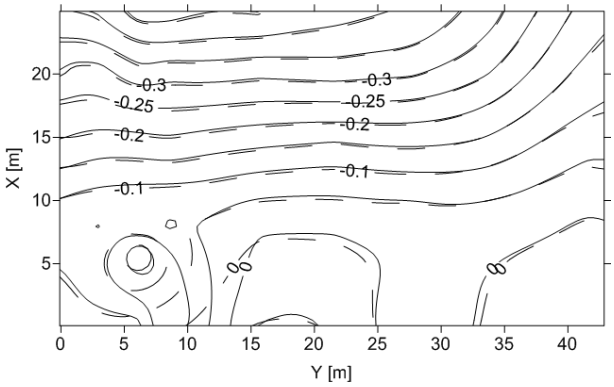

Fig. 6. Differences between the predicted (black isolines) and measured (dotted isolines) values.

Table 3 presents the error values of the learning and testing of the network in the form of the root mean squared error (Jankowski, 2003), given by (6).

Table 3. Errors of teaching and testing of neural networks

Error type [cm]	Teaching method				
	The conjugate-gradient method	Algorith RPROP	The Levenberg – Marquardt's method	The variable metric method	The steepest descent method
Teaching error	0,07	0,14	0,25	0,23	0,42
Testing error	0,15	0,21	0,48	0,59	1,02

4. SUMMARY

The paper presents an attempt of application of unidirectional multilayer neural networks to determine the deflections from flatness and vertical position of the wall surface in the church of the Blessed Virgin Mary in Toruń, for a single measurement period, on the basis of ten periodic measurements. The best results were obtained with the use of the conjugate-gradient method ($RMSE = 0{,}15cm$), slightly worse for algorithm RPROP ($RMSE = 0{,}21cm$), and the least advantageous for the steepest descent method. It should be noted that the quality of the obtained results depends both on the applied optimisation method and the suitably selected network architecture (the number of layers and the number of neurons in the layers).

On the basis of the obtained results, it can be stated that neural networks may be applied to the prediction of deflection from flatness and vertical position. Analysing figures 4 and 5, it can be noticed that the largest differences between measurements and predictions occur for the lower part of the west wall. The differences for the remaining part of the wall are negligibly small and do not influence the interpretation of the results.

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PREDYKCJA ODCHYLEŃ OD PŁASKOŚCI I POZYCJI PIONOWEJ Z ZASTOSOWANIEM SIECI NEURONOWYCH

S t r e s z c z e n i e

W artykule podjęto próbę wykorzystania sieci neuronowych jednokierunkowych wielowarstwowych do predykcji odchyleń od płaskości i pozycji pionowej ścian budynku, na przykładzie pomiarów okresowych kościoła Najświętszej Maryi Panny w Toruniu. Wykorzystane metody sztucznej inteligencji w postaci sieci neuronowych typu sigmoidalnego były uczone metodą propagacji wstecznej błędu, która bazuje na znanych z teorii optymalizacji metodach gradientowych. Prognoza wielkości wychyleń od pionu i płaskości została przeprowadzona dla jednej epoki pomiarowej na podstawie dziesięciu pomiarów okresowych wykonanych w kilkuletnich odstępach czasu.

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INTERDEPENDENCE OF BUILDING ELEMENTS IN THE ANALYSIS OF REPAIR

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The paper presents a comparative analysis of the results of the evaluation of technical wear of residential buildings situated in Żary (a town in Lubuskie Voivodship) with the results of calculated percentage values of wear for the same buildings carried out with the use of time methods. The real technical wear of the buildings occurred to be much more advantageous than the one obtained with the help formulas derived from the time methods. An attempt was also made to determine any correlations between the technical wear of the structural elements of buildings erected in a traditional way and the technical wear of their finishing elements.

Keywords: technical wear, technical wear evaluation, repair needs

1. DESCRIPTION OF RESEARCH OBJECTS

The paper presents the analysis of the evaluation of technical wear of one hundred and sixty 90-year-old residential buildings. The buildings situated in Żary (a town in Lubuskie Voivodship).

The applied building materials and the structural solutions are similar in all the buildings. The masonry walls were made of solid bricks; the floors over the ceilings – masonry, Klein type; the remaining floors – wooden beams; the stairs an the roof structure – wooden, rafter framing – purlin-collar-tie type and in some cases – collar-beam type; roofing – flat tiles or roofing paper.

In order to obtain homogeneous research material, the buildings have been divided into two groups: Group I – includes buildings with inhabited attics, wooden rafter framings and flat tile roofing; Group II – buildings with flat roofs covered with roofing paper.

The technical states of all the buildings were periodically inspected by experts in 2012.

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2. RESULTS OF TECHNICAL WEAR OF THE BUILDINGS

The periodic monitoring, according to article 62 of the Act - Building Law, is the basic responsibility of the building manager and the owner, and the realisation of the follow-up recommendations is the basis for the building proper exploitation. The periodic monitoring, consisting in the examination of technical wear, resulted in the reports [2] containing the information on the percentage wear of 25 components of the 90-year-old buildings. The values of technical wear were determined according to the metric criteria given by W.Winniczek [5].

The results of the technical wear carried out in 2012 are listed in Table 1.

Table 1. Percentage values of technical wear of the selected building components

Selected components of a building		Mean value of technical wear of elements in the examined buildings	Standard deviation
Masonry walls	group I	37,93 %	8,93
	group II	39,10 %	9,04
Wooden floors	group I	39,44 %	10,42
	group II	39,96 %	10,92
Wooden stairs	group I	38,12 %	9,24
	group II	38,46 %	9,70
Timber roof structure	group I	39,96 %	12,24

On the basis of the numerical data, included in the reports, it can be stated that the durability periods of particular elements are longer than the ones given in the bibliography. What is more, the low values of the rate of wear of the components of the 90-year-old buildings reveal imperfections of the equations applied according to the time methods.

The analysis of the wear of the load bearing walls, which was carried out according to the systematically estimated percentage values, resulted in the calculation of an average value:
Group I – 37.93 % with the standard deviation 8.93,
Group II – 39.10 % with the standard deviation 9.04.

According to the formulas of the theoretical time methods, the wear rate of the 90-year-old building should range between 70 – 90%. The values obtained for the existing, examined buildings have not exceeded 40%.

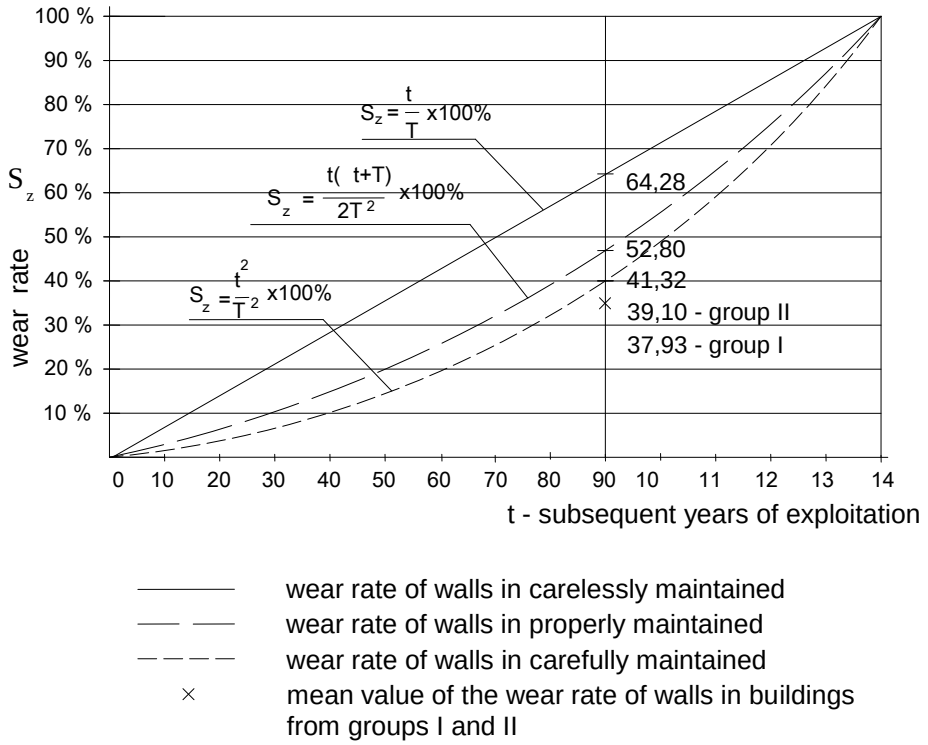

Fig. 1. Comparison of average results of technical wear of masonry walls in the examined buildings with the ones obtained from formulations of time methods

The durability period of the wooden floors is given in the bibliography as 60 -80 years. In the examined 90-year-old buildings, the wear rate in 2012 was estimated 39.44% for buildings in Group I, and 39.96% for Group II. Thus theoretically, the wear rate should amount 100%, whereas the obtained mean value which amounts about 40% – varies considerably.

By the analysis of the results for the rafter framing, a mean value 39.96 % has been obtained, with the standard deviation 12.24. It indicates the divergence of the results, which is due to the repairs carried out in some of the buildings, which included the repairs to the rafting frame and the replacement of the roofing.

Percentage values of technical wear of walls in the 90^{th} year of exploitation calculated with the use of theoretical formulations used in time methods amount:

- in buildings carelessly maintained – 64.28%

- in properly maintained buildings – 52,80%,
- in carefully maintained buildings – 41,32 %.

Time methods determining the technical wear base on two parameters: the prediction of durability time T and the building current age t. The methods are to a large degree simplifications. The obtained results indicate the necessity of further research to determine the durability of building materials more realistically.

3. TECHNICAL STATE OF ELEMENTS CONDITIONED BY TECHNICAL WEAR OF OTHER ELEMENTS

The required values of building utility are conditioned by their proper maintenance and repairs. A considerable degree of wear in the examined buildings was the result of the presence of moisture in structure elements, which occurred due to the leaks in roofs, gutters and downpipes as well as to the lack of insulation of foundations and basement walls. The persistent lack of maintenance and repair of the damaged elements contributes to the further process of the building deterioration.

Z. Ściślewski in [2] proposes a division of buildings into particular parts:

- permanent elements (foundations, bearing walls, ceilings), durability period of which is longer than the assumed durability of the building itself, minor repairs are required,
- replaceable elements (floors, carpentry, external and internal plasters, fittings), partial repairs or total replacement of the components are required,
- repairable elements (electrical and sanitary installations, coats of paints), total replacement of such elements is required.

The permanent elements will be in a better condition if the required repairs of the replaceable and repairable components are carried out in the due time. The mutual relations between the components are also an essential factor conditioning their technical state.

The technical state of a building is conditioned by the susceptibility of its components to the damaging influences of the other components. The coefficient of the relation between the components r_{SzASzB} is the measure of the damaging reactions between elements A and B.

3.1. Interrelationship between the technical state of the timber roof structure and a roof covering

The author carried out a comparative analysis of the technical state of the interrelated components. The relation between the degree of technical wear of a timber roof structure and a roof covering was examined.

The coefficient of the correlation between components was determined with the use of linear Pearson correlation [4]:

$$r_{xy} = \mathrm{cov}(X, Y) / \sigma_x\sigma_y \tag{3.1}$$

r_{xy} - correlation coefficient,
cov(x,y) - covariance, a digit denoting a linear relationship between random variables x and y,
$\sigma_x\sigma_y$ - standard deviation.
Where:

$$\mathrm{cov}(X,Y) = E\,(X\cdot Y) - EX\cdot EY \tag{3.2}$$

E - denotes the expected value.

For correlation between the degree of technical wear of a timber roof structure and a roof coating, formula (3.1) takes the form:

$$r_{SzAB} = \frac{\sum_{i=1}^{n}(SzP_i - \overline{SzP})(SzK_i - \overline{SzK})}{\sqrt{\sum_{i=1}^{n}(SzP_i - \overline{SzP})^2 \sum_{i=1}^{n}(SzK_i - \overline{SzK})^2}} = \frac{\sum_{i=1}^{n} SzP_i SzK_i - \overline{SzP}\,\overline{SzK}}{\sqrt{(\frac{1}{n}\sum_{i=1}^{n} SzP_i^2 - \overline{SzP}^2)(\frac{1}{n}\sum_{i=1}^{n} SzK_i^2 - \overline{SzK}^2)}} \tag{3.3}$$

Where:

$\overline{SzP}, \overline{SzK}$ - respective averages:

$$\overline{SzP} = \frac{1}{n}\sum_{i=1}^{n} SzP_i, \quad \overline{SzK} = \frac{1}{n}\sum_{i=1}^{n} SzK_i \tag{3.4}$$

r_{SzPSzK} - correlation coefficient between the degree of technical wear of a timber roof structure and a roof coating,
$\overline{SzP}$ - average value of the degree of the roof coating's wear,
$\overline{SzK}$ - average value of the degree of the timber roof structure wear.
$\overline{SzP}$ = 46.28 % for standard deviation 13.95,
$\overline{SzK}$ = 39.96 % for standard deviation 12.24.

Coefficient r_{SzPSzK} may take the values from -1 to 1; the greater its absolute value, the stronger relationship between the variables. When the coefficient equals 0.00, it indicates the lack of the mutual relationship.

The obtained value of coefficient r_{SzPSzK} for the examined buildings equals 0.573. It may be stated that the degree of technical wear of the timber roof structure partially depends on technical wear of the roof coating.

3.2. Interrelation between technical wear of a timber roof structure and technical wear of gutters and downpipes

The analysis of the relationship between technical wear of a timber roof structure, expressed in percentage points, and the technical wear of gutters, downpipes, and roof flashings was carried out analogously.

$$R_{SzOSzK} = \frac{\sum_{i=1}^{n}(SzO_i - \overline{SzO})(SzK_i - \overline{SzK})}{\sqrt{\sum_{i=1}^{n}(SzO_i - \overline{SzO})^2 \sum_{i=1}^{n}(SzK_i - \overline{SzK})^2}} = \frac{\sum_{i=1}^{n} SzO_i SzK_i - \overline{SzO}\,\overline{SzK}}{\sqrt{(\frac{1}{n}\sum_{i=1}^{n} SzO_i^2 - \overline{SzO}^2)(\frac{1}{n}\sum_{i=1}^{n} SzK_i^2 - \overline{SzK}^2)}} \quad (3.5)$$

r_{SzOSzK} - coefficient of the correlation between the degree of technical wear of the timber roof structure and the degree of technical wear of roof flashings, gutters and downpipes,

SzO - mean value of the degree of technical wear of roof flashings, gutters and downpipes,

$\overline{SzK}$ - mean value of the degree of technical wear of the timber roof structure.

SzO = 41.47 % for the standard deviation 13.67,
SzK = 39.96 % for standard deviation 12.24.

The correlation coefficient was calculated and amounted 0.036. The value of the coefficient close to zero indicates an inconsiderable correlation between the technical state of gutters and downpipes on the one hand and the technical state of the roof structure.

3.3. Interrelation between the technical state of external walls and external plasters

Also relations between the technical state of the external walls and the technical state of the external plasters were analysed. The correlation coefficient was determined according to formula:

$$r_{SzTSzS} = \frac{\sum_{i=1}^{n}(SzT_i - \overline{SzT})(SzS_i - \overline{SzS})}{\sqrt{\sum_{i=1}^{n}(SzT_i - \overline{SzT})^2 \sum_{i=1}^{n}(SzS_i - \overline{SzS})^2}} = \frac{\sum_{i=1}^{n} SzT_i SzS_i - \overline{SzT}\,\overline{SzS}}{\sqrt{(\frac{1}{n}\sum_{i=1}^{n} SzT_i^2 - T)(\frac{1}{n}\sum_{i=1}^{n} SzS_i^2 - \overline{SzS}^2)}} \quad (3.6)$$

r_{SzSSzT} - correlation coefficient between the technical state of external walls and the technical state of external plasters,

$\overline{SzS}$ - mean value of the degree of the technical wear of external walls,

$\overline{SzT}$ - mean value of the degree of technical wear of external plasters.

$\overline{SzS}$ = 37.93 % for standard deviation 8.93,

$\overline{SzT}$ = 38.08 % for standard deviation

The correlation coefficient was calculated r_{SzTSzS} and equalled -0.110. It indicates the fact that the technical state of walls depends on plasters, but only in an inconsiderable extent, approximately 11-percent.

4. CONCLUSIONS

Any damages to the buildings performed in a traditional technology are caused by various reasons. Apart form the natural material wear, damaging influence of atmospheric processes, topographic factors, mistakes in projects, various kinds of natural disasters, there is also one essential factor resulting in the building damaging – which is the abandoning of the repairs and overhaul activities. During the exploitation period, current repairs and overhauls consisting in the removal of any flaws should be performed.

The technical state of components in a building is conditioned by the degree of wear of other components. The obtained correlation coefficients between the technical states of the selected components confirm the thesis. The obtained correlation coefficients do not reveal a tight relationship between the technical states of building components. They indicate though, needs and demand for the repair of the finishing elements. The correlation coefficients provide information on the influence of the technical wear of finishing elements on the technical state of structure elements.

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WSPÓŁZALEŻNOŚĆ ELEMENTÓW BUDYNKU W ANALIZIE POTRZEB REMONTOWYCH

Streszczenie

Poszukiwanie skutecznych metod programowania działalności remontowej budynków mieszkalnych wymaga określenia potrzeb naprawczych. Potrzeby te wynikają przede wszystkim z postępu zużycia poszczególnych elementów składowych budynku. W artykule przedstawione są wyniki oceny stanu technicznego budynków mieszkalnych w Żarach (miasteczko w woj. lubuskim) wykonanych w technologii tradycyjnej. Stopień zużycia tych budynków okazał się bardziej korzystny niż uzyskany z obliczeń według wzorów metod czasowych. Wartości liczbowe zawarte w protokołach kontroli okresowych wskazują, że budynki są w lepszym stanie technicznym niż wynikałoby to z obliczeń zgodnie z wzorami. Fakt ten stanowi kolejny przykład wątpliwości zawartych we wzorach. W artykule przedstawione są także wyniki analizy wpływu stanu technicznego elementów w budynku na stopień zużycia innych elementów. Podjęta została próba ustalenia korelacji między stanem technicznym elementów wykończeniowych a stanem technicznym elementów konstrukcyjnych. Otrzymane współczynniki korelacji wskazują na potrzeby remontowe elementów wykończeniowych budynku, stanowią podpowiedź na temat wielkości wpływu stanu technicznego elementów wykończeniowych na elementy konstrukcyjne budynku.

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TRANSFORMATION OF AN INDUSTRIAL FACILITIES – REVITALISATION OR ADAPTATION

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At the turn of the century Polish cities witnessed radical changes due to the political, economic and social transformations which resulted in the technical, social, and cultural degradation of the existing former industrial buildings. On the wave of the common process of revitalization in recent years, many industrial buildings have been transformed. Although the revitalisation processes in our country are based on the recommended by the EU document called - Local Revitalization Programme - in many cases only the easiest type of regeneration is actually taking place, i.e. an adaptation of the object. Its main feature is the lack of a significant contribution to the development of the surrounding areas, in spatial and social terms. This is due to inadequate level of organization of our state, government agencies and legal regulations. The project described in this paper, which has been elaborated as the Master's Thesis, shows the type of action that can be called "grassroots" revitalisation, emerging from the citizen's initiative, with the real participation of local communities, and the needs and methods of their fulfillment properly recognised and defined.

Keywords: transformation of industrial facilities, revitalisation, adaptation

1. INTRODUCTION

Polish towns witnessed a radical change caused by political, economic and social transformations at the turn of the century. As a result of the processes, we can observe technical, social, and cultural degradation in the areas of numerous towns. The changes in the industrial structure, in fact the liquidation of many industries, resulted in the fact that the process affected mainly industrial areas and facilities. On the wave of the commonly occurring revitalization processes,

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many industrial buildings have been transformed in recent years. Unfortunately, in many cases, we have more to do with the easiest way to regeneration, which is an adaptation of the object. The main feature of this type of activity is an insignificant contribution to the development of its vicinity in terms of spatial and social development.

2. REVITALISATION – PATTERNS

Transformations of industrial objects are associated with the phenomenon known as revitalisation, a concept that has commonly been present in our minds for over past few years. With the accession to the European Union, Poland gained financial assistance aimed at supporting the restructuring and modernization of the economy. This support has contributed to reducing economic and social disparities between Poland and the rest of the EU countries.

Revitalization has been seen as one of the most important intervention methods. The notion, which at the beginning was mainly associated with renovation of the material structure of the towns, has gained new meanings and has started to covered social and economic aspects. Poland was one of the first countries, which included revitalization priorities into the Structural Funds. Implementation of the revitalization processes in our country is based on a document recommended by the Integrated Regional Operational Programme for urban development planning - Local Regeneration Programme. This document as the sum of European experiences in this field is based on projects such as: Urban, Quartier en Crise and programs Sociale De Stadt German and Stadtumbau.

Connecting the transformation issues of postindustrial areas to the mentioned above brownfield revitalization programs seems to be necessary. Brownfield sites often occupy vast areas in the structure of modern cities. It is this scale which makes it impossible to revitalize these areas in isolation from the rest of the city. This scale forces to involve as many parties as possible in the revitalization process. If any revitalisation undertakings on the structure of a town are expected to be effective, they must integrate many aspects. The principle of sustainable development is manifested in the fact that social participation, the organizational role of the administration and its tools in the form of statutory planning instruments constitute a counterweight to such items as the market, demographic and economic processes which are often unpredictable and spontaneous. The balance of forces is to enable local communities to express their rights and to disagree with the dictates of economic and technical factors.

The realities of the countries of Western Europe, the brownfield redevelopment has taken place within the large-scale regeneration programs. The prime example is the action of IBA Emscher Park (International Construction Exhibition dedicated to the restructuring of the industrial areas in the Ruhr District). Another interesting example is the Gasometer City, Vienna, or a relatively recent investment: Hafen City in Hamburg.

In 1989, the Provincial Government of North Rhine Westphalia designed the IBA Emszer Park. The campaign was to answer the question: how to revitalize the Ruhr brownfield areas. The initiated venture resulted in over 100 projects. One of the most famous implementations is the revitalization of the industrial complex of mine and coking plant Zollverein in Essen.

Revitalization of the area consisted mainly of maintaining buildings and industrial structures and the conversion of degraded land surrounding the objects into a recreational green space supplied with a system of walking and cycling paths. The performed in 2002 by Rem Koolhaas masterplan for the development of the area assumed the introduction of new modern buildings. It resulted in the realised the so-called SANNA building. The further stage of process is aimed at the development of the arts industry, and 3.5 acres of land was allocated for young creative businesses. In 2006, one of the most spectacular buildings designed by Rem Koolhaas and Hainrich Boll was completed. The former building of coal washing was converted into an exhibition building of free-standing escalator (the longest free-standing escalator in Europe - 55 meters).

Another interesting and spectacular example of industrial facility conversion was the rebuilding of Vienna former gasometer buildings. Only brick exterior casings remained after the nineteenth century, largest in Europe gas reservoirs. They were not so much adapted (as the casings did not constitute a volume), but were used as a distinctive element in a multi-purpose building containing apartments, services in a form of shops and restaurants, offices, an indoor arena and car parks. The whole premise is connected with an existing city with new specially-built roads and an underground. The proposed function, its diversity, architectural quality and the uncommon solution of adapting this type of object for housing needs, have resulted in vast popularity of the building amoung tourists, which had been expected and intended by the authors. The four transformed objects, along with three newly designed complementary objects, create a new centre for its housing district.

The new HafenCity housing district of Hamburg is formed in the area of the former port and industrial areas. The existing historical buildings are adapted and supplemented with new modern buildings, but inspired by the milieu of the existing industrial and port development. Now, HafenCity is

experiencing an intensive development. New office buildings for 40,000 newly-created jobs are being built, as well as new housing buildings for 12,000 people, commercial objects (shops and services), and cultural facilities such as: Internationales Maritimes Museum Hamburg and Hamburg Elbphilpharmonie.

The presented revitalization examples display the preservation of cultural identity and the substance of cultural heritage, high architectural quality and functional diversity. The multiplicity of parties involved in the revitalization process ensures that the problems were defined properly and the proposed solutions feasible. All these elements result in the fact that the carried out works change permanently the degraded environment by creating new values in spatial social and economic terms, a sustainable manner.

3. REVITALIZATION – POLISH REALITY

In Poland, we have also witnessed examples of transformations of industrial facilities in the last few years. A question can be raised - how many cases and to what degree these transformations can be called recapitalizations. Generally, they can be divided into two basic groups. The first one, I think the most ambitious but also most difficult, comprises revitalisation projects which include not only physical undertakings (rehabilitation of the building substance with simultaneous adaptation to new functions), but such transformations which, through the proposed functions, permanently affect the social and economic situation of the revitalized areas. It is a difficult task, and this type of actions are in the minority. The Education and Business Centre in Gliwice can be seen as an examples of this type. The guildhall and the machinery buildings of Gliwice mine, which originated in 1910-1912 and were designed by Berlin architects Emil Zillmann and Georgia, were not protected from devastation. Extensive areas located close to the city centre full of post-mine relics – spoil tips, mine shafts - became property of the city. The technical and architectural revitalization is carried out properly. It is difficult to assess the accuracy of the decisions relating the new functions of the facility. The object in the form designed by the revitalization plan is functioning properly. However, it should be stressed that the impact of this investment on the town, or even its close neighbourhood, does not seem considerable. The assumed function, i.e. a higher vocational university in the context of the existing the Silesian University of Technology and some subsidiaries of other universities, does not seem too appealing. The Enterprise Incubator also seems quite trivial idea. The assumed functions do not produce significant changes in the labour market and employment in the scale of the city or even the neighbourhood. In the longer term, they dependent on many factors (for school the threat may be the

demographic changes, whereas for the business centre - the weakness of the economic base).

The vast majority of revitalisations belongs to the second group, where transformations of post-industrial buildings include only adaptations. Basically, they can be divided into two groups. The first group comprises shopping centres and industrial facilities. Stary Browar in Poznań and Manufaktura in Łódź are their most spectacular examples, which have been launched in the last few years. Both of them have been realised in a large scale, which was the consequence of the original size of the objects. In both cases, their commercial and entertaining functions were supplemented with a cultural offer. In one instance, they are a permanent sculptural exhibition and a temporary exhibitions. Manufaktura in Łódź houses the scene of Teatr Mały and the Museum of Factory. The revitalization works were carried out at a very good technical and architectural level. However, the revitalisation process included adaptation works exclusively. These investments do not create a new quality in a broader sense, it is rather an oasis of luxury in the "sea of unresolved problems". On the contrary, some of the problems associated with decapitation, degradation of city centres have even become deeper. Such understood revitalization may lead to a greater degradation of the land around these objects. The introduction of strong economic subjects (retailers located in these facilities) may lead to the elimination of small businesses (shops and services) in the centres of old towns.

The last group of transformations comprises industrial facilities which were adopted for the apartment buildings. In the last few years, we have witnessed a lot of such transformations. To name a few examples: Fabryka Tytoniu Fajwela Janowskiego (Faivel Janowski's Tobacco Factory) - 155 flats, (Białystok, 2008-2010), Spichlerz (Granary) - 30 flats (Gliwice 2008-2009), Drukarnia Narodowa (National Printing) - 46 flats (Kraków 2009), Młyn Ziarno na Zabłocie (Grain Mill in Zabłocie) - 46 flats (Kraków 2008-2009), Fabryka włókiennicza Karola Scheiblera (Karol Scheibler's Textile factory) in Księży Młyn - 400 lofts (Kraków 2007-2010), Koszary Wojskowe (Military Barracks) Poznań - 134 apartments (Poznań 2006-2008), Destylarnia Braci Wolff (Wolff Brothers' Distillery) - 52 lofts (Wrocław 2008-2012), Tkalnia (Weaving Plant) - 36 flats (Poznań 2007-2008), Przędzalnia lnu (Spinning flax) - lofts de Girarda 178 lofts, Stara Przędzalnia (Old Spinning) – 76 lofts (Zyradów 2009-2011) (1). All of them seem to offer good quality solutions both in terms of design and construction. Once more, we find these areas as oases of luxury, surrounded by the grey reality of degraded urban areas.

The mentioned above completed transformations are commonly referred to as "revitalisation". However, this brief overview of the projects shows that

the term is overused or even used illegitimately. Generally, most of the implementations are performed just to sell the objects for commercial purposes. Even in those cases in which the functional program includes cultural and educational institutions they seem to be poorly motivated, sensitive to small changes and they do not seem to generate a significant contribution to the development of the region. This proves that the decisive factors, i.e. local authorities, have a poor understanding of the real needs of the city. The inactivity of local authorities as well as their helplessness, due to their poor qualifications, result in the lack of social participation and drastically limit the number of parties involved in the revitalization process. In this situation, the market influences and extorts the character of the investment. A further consequence of this fact is a lack of social control over what is happening in the cities. In cases involving the conversion of former industrial sites, local shops and services are closed down without which the centre of the town cannot exist. Lofts create a luxurious ghetto for wealthy people.

4. “GRASSROOTS” REVITALIZATION

The presented above concerns, which in my opinion are quite commonly expressed, stand in a sharp contrast to the activities of commune authorities in the form of Local Revitalization Programs. Generalized model of organizational revitalization of European programs is a complex model assuming sectoral integration and cooperation of numerous elements which interact both vertically and horizontally.

For the less experienced and less efficient administrative structures, which we have in our country, and which are unable to follow this complex procedure – revitalisation actions can be called “authority-imposed” activities, where participation of local communities is replaced by arbitrary actions. Therefore, the Local Regeneration Programs function in our country in two categories: “let's get rid of the problem” (former industrial buildings are transferred to investors for shopping centres or lofts) or “let's do something” (the program includes minor and trivial works such as cleaning public spaces or repairs to buildings).

In the context of the revitalization issues, I would like to present a Master's Thesis of Mr. Kamil Cierpioł titled "A complex of social apartments for victims of catastrophes, on the example of the reconstruction of the old Department of Tannery in the village of Mochała", performed at the Faculty of Architecture of the Silesian University of Technology.

The subject was approached on the bases of the real, local, specific needs. The adapted object is located in the village of Mochała in Lubieniecki district.

The author of the project comes from the area and knows its realities and problems. One of the greatest tragedies that unfolded there, were strong storms on August 15, 2008. Within several minutes, the storm broke the roofs of many houses, power lines and destroyed crops. In the tragedy, two people were killed, and more than 100 houses were destroyed. Another problem, this time not of an incidental but repeated character, are local flooding. The largest of which were the floods in 1997 and 2010.

The aim of the Master's Thesis was to design a transformation of the former industrial facilities into a building that would provide a shelter for "people affected by a natural disaster or other tragedy", together with a conceptual design of buildings for social housing applying various elements of the existing infrastructure. The function was supplemented with premises for commercial purposes, a conference room, offices for social assistance services. The main element of the project was a shelter for victims, which was planned in the existing industrial building. The author proposed a method of the building exploitation that allows arrangements depending on the need. The method permits different utility variants, which are realised with the use of such elements as: beds, curtains, and other equipment rescued from disaster. This type of arrangement ensures the basic needs in an emergency for a few days or weeks, depending on the needs. In addition to emergency cases, the facilities can serve the community as a place for rent for various events and trainings.

Another important element of the system is the introduction of social building. The introduction of permanent residents to the complex, which incorporates such elements as: the offices of commune agencies, catering, small local businesses, may become an important functional element for numerous surrounding communities. The buildings for social housing, in the proposed solution, are planned to utilise the existing floor slab and to be erected as light, system-based, wooden construction. The buildings are to be erected by construction crews consisting of persons affected by the tragedy and their neighbours basing on a short operating instructions and training, under the supervision of qualified people. The region which this facility is intended to is the town of Herby and the surrounding communities belonging to the Lubienicki district.

The author's main objective was to create a centre that utilises and adapts former industrial buildings, and to indicate the ways of use and revitalization of the devastated land, a abandoned tannery plant complex.

The basic elements of the proposed by the author design of the revitalization of the brownfield area, are well-recognised local needs, rational and realistic definition of the scope of investment and the ways of its

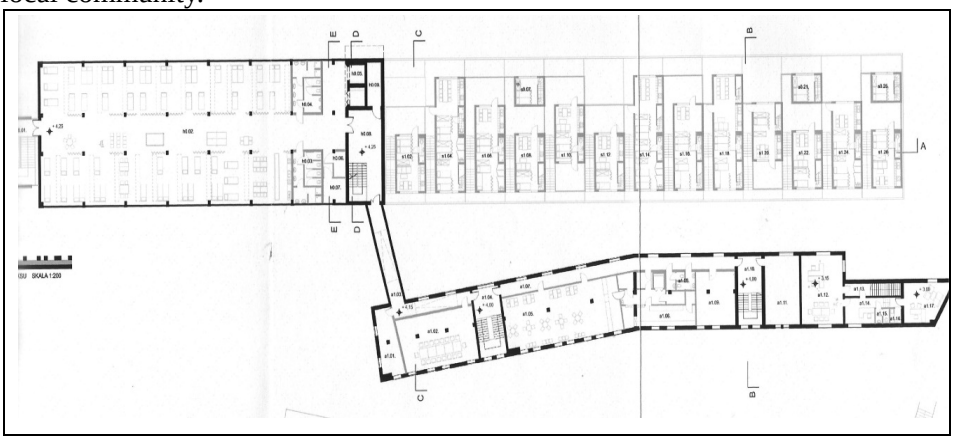
implementation. The project is performed in stages and provides the possibility to perform the particular stages in an arbitrary order.

It is also important that it involves a number of entities (many communities would be interested in the cooperation in the project) as well as individuals affected by the tragedy who would contribute to the project realisation through their own work. The author consulted the project with local authorities interested in the subject. The completed project was presented to the officials. This type of action may be called “grassroots” revitalization, emerging at a citizen's level, with real participation of local communities, where needs and solutions are well-defined.

5. SUMMARY

The political and economic changes which took place at the turn of the century did not bring in my opinion the expected effects in many areas. Perhaps it is most visible in the field of urban planning, which is unable to control the deterioration of the downtown. Unfortunately, the system solutions developed in Western European countries do not work in our country. The main reason is the insufficient degree of organization of our country in general, and its administration and legal regulations, in particular.

The proposed project is not a ready solution. However, it shows that local activities initiated by the lowest level of government and local communities may result in making rational decisions also in our conditions. In this situation, the most important issue is to change the philosophy of action. Its main element should be to determine the correct proportions between the weight of the decisions taken at various levels of government and the decisions taken by the local community.



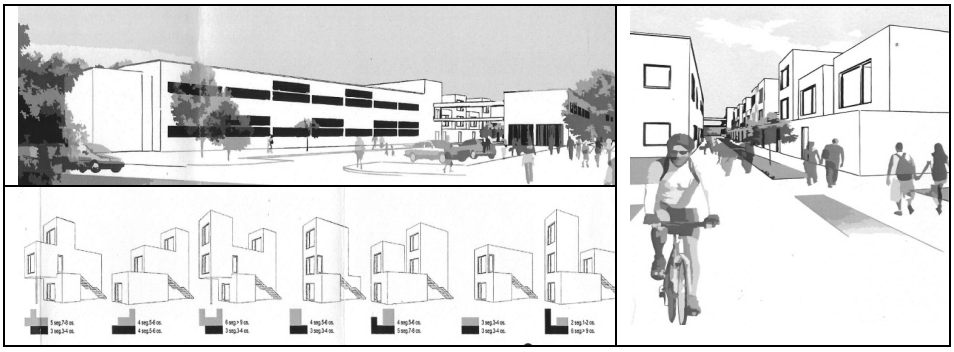


Fig. 1. The complex of social housing buildings and apartments for victims of disasters elaborated by K. Cierpioł as Master's Thesis; Projection of the ground floor of the adapted hall (shelter) and a complex of social housing, visualization, options of systems of social housing buildings.

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PRZEKSZTAŁCENIA OBIEKTÓW PRZEMYSŁOWYCH - REWITALIZACJA CZY ADAPTACJA

S t r e s z c z e n i e

W polskich miastach na przełomie XX i XXI wieku nastąpiły radykalne zmiany spowodowane przekształceniami politycznymi, gospodarczymi i społecznymi skutkujące degradacją techniczną, społeczną oraz kulturową istniejącej zabudowy przemysłowej. Na fali powszechnego procesu rewitalizacji w ostatnich latach wiele obiektów przemysłowych uległo przekształceniom. Mimo, że procesy rewitalizacyjne w naszym kraju odbywają się na podstawie rekomendowanego przez UE dokumentu o nazwie - Lokalny Program Rewitalizacji - w wielu przypadkach mamy do czynienia tylko z najprostszym sposobem rewitalizacji, czyli adaptacją obiektu. Główną jego cechą jest brak istotnego wkładu w rozwój najbliższego regionu w sensie przestrzennym i społecznym. Spowodowane to jest niedostatecznym stopniem organizacji naszego państwa, administracji i regulacji prawnych. Przedstawiony w artykule projekt dyplomowy ukazuje typ działania, który można by nazwać rewitalizacją oddolną, powstającą na poziomie obywatelskim, w której udział lokalnych społeczności jest realny a potrzeby i sposoby ich zaspakajania są zdefiniowane w sposób prawidłowy.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

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TECHNICAL MISHANDLES OCCURRING IN BUILDING RENOVATION AND MODERNIZATION

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The paper presents current technical requirements related to adaptations, extentions and modernizations of building facilities according to the binding legal and technical documents. It also presents the technical reasons that affect the reliability and durability of repairs and modernizations which occur at the designing and the execution stages. The most common errors and deviations from the accepted principles are listed. At the end, some examples from the practice both in design and in execution are discussed, referring to all types of buildings. Also some proposals were formulated. They related to the elimination of technical errors and improvement of the quality of realized repairs, strengthening and modernizations.

Keywords: repairs, refurbishments, modernizations, adaptations

1. INTRODUCTION

Contemporary products, materials and technologies for the repair, strengthening, adaptation and modernization of buildings are based on the modern achievements in chemistry and technology.

They should have formal certifications in terms of safety, durability, health, acoustics, heat, performance requirements, environmental protection and sustainable development [1÷6].

Contemporary materials engineering as well as a wide range of polymers, offer increasing opportunities for repair and modernization of buildings. Polymeric and polymer-mineral materials allow repairs and reinforcements, both inside and outside buildings. Materials used for exteriors need to meet higher standards since, apart from the physical-mechanical parameters, they need to be resistant to harsh weather conditions. Whilst, the interiors of a building are

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exposed to the following destructive factors: mechanical, chemical, thermal, dynamic, etc., depending on the type of a building element.

Optimal selection of the technology of repairs and reinforcements should always be adapted to the user's requirements. Their diverse and effective properties are conditioned by a proper design is implementation within the conducted renovation, adaptation, extension and modernization works.

2. TECHNICAL REQUIREMENTS FOR ADAPTATIONS, EXPANSIONS, MODERNISATIONS

The adaptations and expansions as well as the renovation and modernization of buildings must follow some basic technical requirements that are specified for newly-implemented objects.

Safety requirements for the adapted and extended structures refer to the general principle of ensuring adequate reliability and stability of components or entire buildings, for the period of intended use.

Fire safety in renovated and modernised buildings primarily consists in meeting the emergency evacuation requirements, ensuring appropriate ventilation, stairways and zone lifts.

In terms of health and environmental protection, the adaptations and building extensions should prevent any gas emissions from the used materials, dangerous radiation, dangerous particles or gases in the air, moisture or improper waste disposal.

The safety of the adapted and modernized buildings involves the prevention of accidents such as slippings, collisions, burns, electrocution, etc.

Whereas, issues of protection against noise and vibrations are the ones which are most essential for the building use, especially historic ones or situated in densely built-up areas.

Repairs, adaptations, expansions or modernizations of buildings should be considered in the two following aspects:

- to ensure the acoustic quality of the object and its partitions determined by the users' needs
- to improve the acoustic performance as one of the goals of modernization.

In both cases, it is necessary to determine the acoustic requirements to be met by buildings being renovated and modernized.

Thermal insulation of partitions in modernised buildings includes the implementation of, inter alia, the following issues:

- the assessment of the suitability of various insulation methods depending on the type of construction of partitions,
- elaboration of new improved methods of insulation and energy saving.

3. TECHNICAL REASONS AFFECTING THE QUALITY OF RENOVATION AND MODERNIZATION OF STRUCTURES

Errors or poor quality of repairs and modernization of buildings result mainly from the erroneous design and inaccurate construction works.

The most common technical and organizational causes influencing the poor quality of repairs and buildings include:

designing and programming stage:

- inadequate and erroneous diagnosis of the ground and the water-ground conditions under the modernised facilities or infill buildings especially in densely built-up areas,
- erroneous determination of the ultimate loads for the grounds and the acceptable settlements for the specific type of a construction before and after modernisation,
- inappropriate foundation and its improper design without taking into account its interaction with subsoil,
- the assumed types of construction and foundation of a modernized facility are inappropriate for applied technologies or requirements imposed by its specific uses,
- non-compliance with or incorrect interpretations of standards, technical approvals and recommended instructions for renovation and modernization of buildings,
- unjustified deviations from the standard, technical approvals and guidelines for renovation and modernization of structures in special conditions,
- erroneous diagnosis of the behaviour of the structure under unusual loads, such as para-seismic loads and loads from wind, snow, dust, ice, etc.,
- engineering and technical errors while designing such elements as ties, joints, connectors, as well as whole structures,
- inappropriate or incorrectly selected technologies, types of materials, structural and finishing components,
- insufficient attention paid to investors' and users' opinions and remarks, especially in repeated implementations,

the performance stage included the following errors:

- changed conditions and types of foundation during renovation and modernization,
- lack of sufficient subsoil tests before the commence of renovation and modernization,
- poor quality of concrete, materials and other construction products used in the processes,
- usage of damaged and incorrectly selected materials and elements,
- poor performance of joining and connecting construction elements,

- applying construction materials and products which are unapproved or which do not possess necessary certifications,
- inadequate supervision of quality of used materials and products, and inadequate progress supervision,
- insufficient knowledge of the properties of new materials, products and construction systems,
- failing to meet the construction standards and inadequate technical supervision,
- insufficient understanding of the work by contractors renovating the structures, as well as the conditions of their use, which may result in improper changes introduced into the project during the realisation process,
- effects of weather factors during the renovation and modernization of buildings,
- insufficient co-operation between designers and contractors.

Long-term analyses indicate that hazards, breakdowns and construction disasters affecting, inter alia, poor quality of renovated and modernized buildings have been caused, apart from random factors, by human errors made at the design and execution stages. The reasons are shown in Figures 1 and 2.

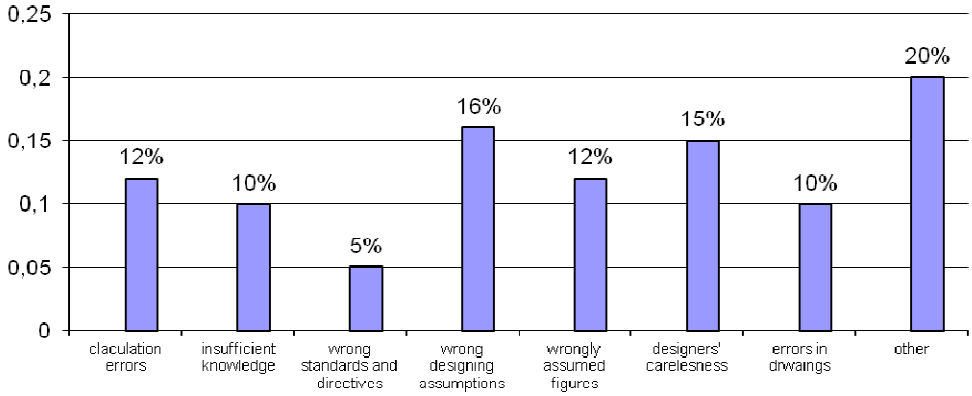

Fig. 1. Long-term design reasons affecting, inter alia, the quality of repairs and modernization of buildings.

The most common design reasons influencing the poor quality of repairs and modernization were generally wrong design assumptions, negligent design, insufficient knowledge and calculation errors.

The most common reasons of poor performance were: generally negligent contractors, insufficient qualifications, insufficient knowledge, deviations from the design and poor quality of joining elements.

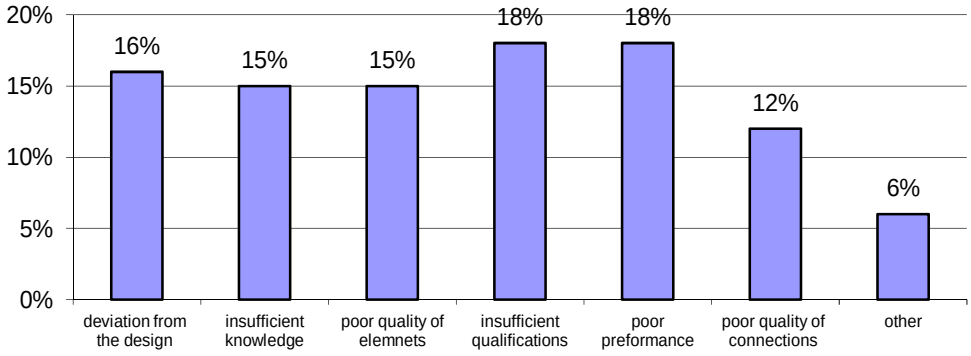

Fig. 2. Causes of poor performance which affect the quality of repairs and modernization of buildings

4. EXAMPLES

Examples of the most common reasons contributing to the poor quality of the renovation and modernization of buildings dependant on the participants of the investment process included:

- **Improper design of** elements of ceilings and floors, massive concrete elements, layered walls in buildings, elements fastening façade to the structure and connections, expansion joints of large-size structures, as part of the modernization of buildings, superstructures, repairs and reinforcements, as well as assuming wrong loads and static charts.
  These related in particular:
  - ceilings and reinforced concrete and steel columns, especially in commercial and storage facilities,
  - foundation slabs especially for infill buildings erected in densely built-up areas,
  - reinforced concrete diaphragm walls for deep foundations,
  - commercial buildings, warehouses and storage rooms,
  - suspended ceilings in buildings designed for various purposes,
  - internal walls and claddings of buildings,
  - entertainment and multi-purpose auditoriums,
  - water, thermal and acoustic insulation of facilities designed for various purposes,
  - trim elements such as plasters, linings, floors, joinery, etc.
- **Inadequate performance** of concrete work, connections between reinforced concrete and timber elements, bonding and connections of steel elements, scaffolding and operation stiffeners, water and acoustic insulation,

trim and auxiliary elements, infill buildings, demolitions and additions, superstructures, floors, light partition walls, window and door elements, etc.
These related in particular:

- reinforced concrete diaphragm walls and foundations, most frequently in infill buildings,
- tower structures, reinforced concrete and masonry structures,
- walls, columns and ceilings made of concrete blocks or similar materials,
- skeletal structures and reinforced concrete multi-storey garages, both underground and free-standing,
- infill buildings in towns,
- multi-purpose pre-stressed structures
- roofs of various roof structures,
- water, thermal and acoustic insulation in buildings,
- balconies and trim elements of buildings
- outbuildings and single-family houses;

5. SUMMARY AND CONCLUSIONS

The presented technical reasons elaborated on the basis of the long-term analysis of errors resulting from the analysis of risks, breakdowns and disasters of buildings allow for an overall assessment of the influence of the design solutions and execution at various stages of the investment process (including the renovation and modernization) on the safety, reliability, durability and the rate of failure of buildings.

They show that the existing risks, failures and disasters of renovated and modernized facilities are due to specific technical, organizational, legal, administrative, financial, social and other reasons.

Since the analysis included objects of a very different character, in terms of technical, economic and organizational aspects, the presented errors reveal a wide range of problems in the field of engineering, economics, organization and management.

At all stages of the investment process, there is still too much negligence, poor organization, lack of adequate technical supervision, insufficient knowledge of contractors and users, as well as other characteristic errors of renovation and modernization.

They affect, to the greatest extent, the quality and maintenance of the renovated and modernized buildings.

Without a critical assessment of the existing resources and the principles of their collection and use, it is impossible to think of making positive changes in both the investment and operational processes.

Information on threats, emergencies, failures and construction catastrophes should be used to improve the quality of renovated and modernized buildings. They should also be used in determining the technical, organizational and administrative regulations.

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BŁĘDY TECHNICZNE WYSTĘPUJĄCE PRZY REMONTACH I MODERNIZACJACH OBIEKTÓW BUDOWLANYCH

S t r e s z c z e n i e

W artykule przedstawiono aktualne wymagania techniczne związane z adaptacją, rozbudową i modernizacją obiektów budowlanych zgodnie z odpowiednimi dokumentami prawnymi i technicznymi. Przedstawiono również przyczyny techniczne wpływające na trwałość i niezawodność remontów i modernizacje występujące w procesie projektowania i programowania oraz w wykonawstwie. Wymieniono najczęściej występujące błędy i odstępstwa od przyjętych zasad. Na zakończenie przedstawiono niektóre przykłady z praktyki zarówno w projektowaniu jak i w wykonawstwie, dotyczące wszystkich rodzajów obiektów budowlanych. Sformułowano też wnioski w zakresie eliminowania błędów technicznych i polepszania jakości realizowanych remontów, wzmocnień i modernizacji obiektów budowlanych.

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IMPACT OF KARL HENRICI'S IDEAS ON THE DEVELOPMENT OF SETTLEMENTS IN KNURÓW IN THE YEARS 1904-1939

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German planners trying to effectively solve the problems of the complex housing situation at the beginning of the 20th century, eagerly reached for the ideas of the Austrian planner, Camillo Sittego (1843-1903), who in his designs[1] drew attention to architectural scale, proportions and the presence of spatial elements such as squares, green areas, as well as the breadth and the distances of buildings. It has also become important to access recreational, cultural and service facilities as easily as possible. Knurów Settlements were designed according to these principles. Their intensive development took place 1904-1939.

Keywords: industry-owned housing estates for workers, building typology, workers' Settlements, cultural identity.

1. INTRODUCTION

Since 1904 a number of changes were introduced in the plans and the location of the project of Knurów Settlement.

However, since its implementation up to the present, little has changed the spatial shape of the estate. The most valuable, in terms of urban design and architecture, is Settlement III for workers. It was created in a unique period, when many architects have tried to change the approach to design. Knurów Settlement III incorporated a modest type of a farmhouse with a garden, referring to the English cottage, and Henrici's ideas, visible in the urban system,

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[1] described in detail in Sitte's work: *City planning according to artistic principles.*

which expressed the avant-garde ideas in architecture. The picturesqueness and the simplicity of the architecture shaped its unique character. The Settlement III for workers, along with Settlements for office workers and Settlement IV, is a great example of this type of building from the early twentieth century since it is one of the few Settlements which preserved almost unchanged to the present day. This constitutes about its uniqueness and value as a monument of architecture and thus, by cognitive identification, contributes into the protection of the cultural milieu and may help to take steps to alter the image and enhance the attractiveness of Knurów, and in the long term the quality of life.

2. THE DEVELOPMENT OF A COMPLEX OF SETTLEMENTS IN KNURÓW

The settlement in Knurów was associated with the discovery of coal and the construction of the mine. Knurów, a former small village, becomes a mining town [6]. The development of Settlements in Knurów took place in the years 1904-1939. This is when subsequent complexes of houses were erected, which differed in the character of building. The preparatory works aiming at constructing of the mine (exploration of resources, land dimensioning) were commenced yet in 1889. Developing mining industry required more and more employees. Thus, yet in 1903 it was obvious that it would be necessary to built a housing estate for the employees. The management of the company decided to recognize the housing needs for workers. They obtained sample projects with cost estimates from neighbouring companies: the Ballestrem and the Schaffgotsch families. Plans and designs for four-family houses and two-family houses were received, with the information that they are most willingly inhabited by workers. Basing on the data, the first designs were elaborated. These included: a four-family house, designed in 1903; houses for the I Settlement for office workers (designed in 1903, the implementation started in 1904). All properties are built in a similar style with elevations made of brick with plastered planes, tiled roofs. The system did not stand out for its special urban planning. Until 1915, the construction was maintained according to the plan, in a uniform style. This Settlement was demolished in the 80s, and the land was designed for new housing estates.

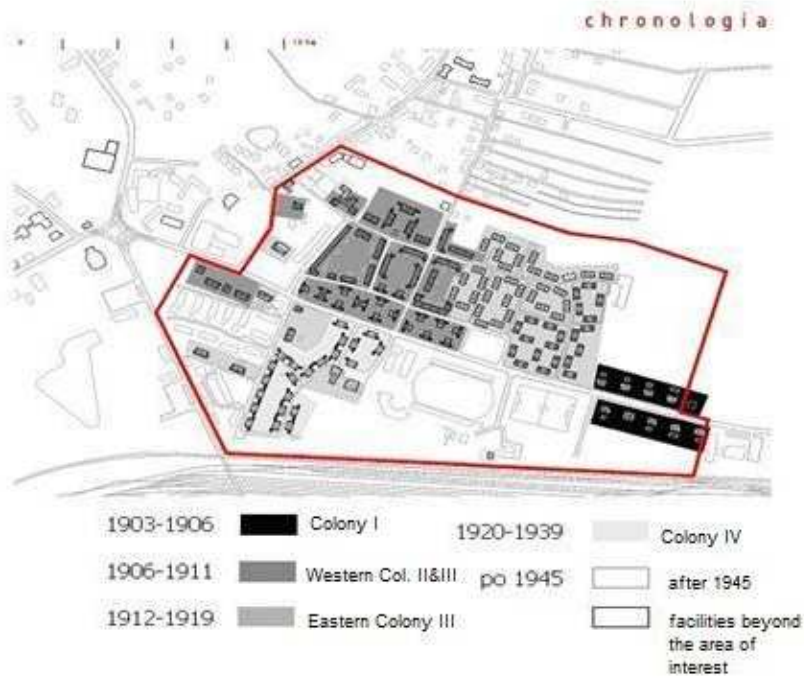

Fig. 1. The chronology of the construction of the particular parts of the estate (according to Ciosek J., 2008)

The situation changed significantly when a prominent German city planner, Karl Henrici, Professor at the Department of Architecture of the Technical University of Aachen, was invited to Knorów, presumably as a consultant to the design, by local architects in 1904, who at that time was an undercover government counsellor, a decorated for his achievements in construction and transportation. He began the work on the project by identifying the needs of local population and the elaboration of a functional program of the estate. The plan included to build a Settlement consisting of about 1,000 houses for workers and 100 houses office workers. In his note entitled "Results of site investigation visit and a meeting in Knurów 28.10.1904" Henrici writes:

„First of all, the plan should relate to the existing groups of houses; however in such a way that it would produce a closed image of the town. The plan should include the diversification of people. To achieve this, some land plots should be designed for merchants, craftsman, etc., or they should be exchanged" [5].

As a result, in 1904-1905 Henrici prepared a self-study model project. It assumed a north-south arrangement of roads which would join the Settlement with the plant. Three ways led to places were public utility buildings were grouped. The main road, situated in the vicinity of the mine yard [5], led to the centre (market square) of the Settlement. The market square constituted the central point of the design. It was surrounded by two-floor houses as well as the most important public utility buildings.

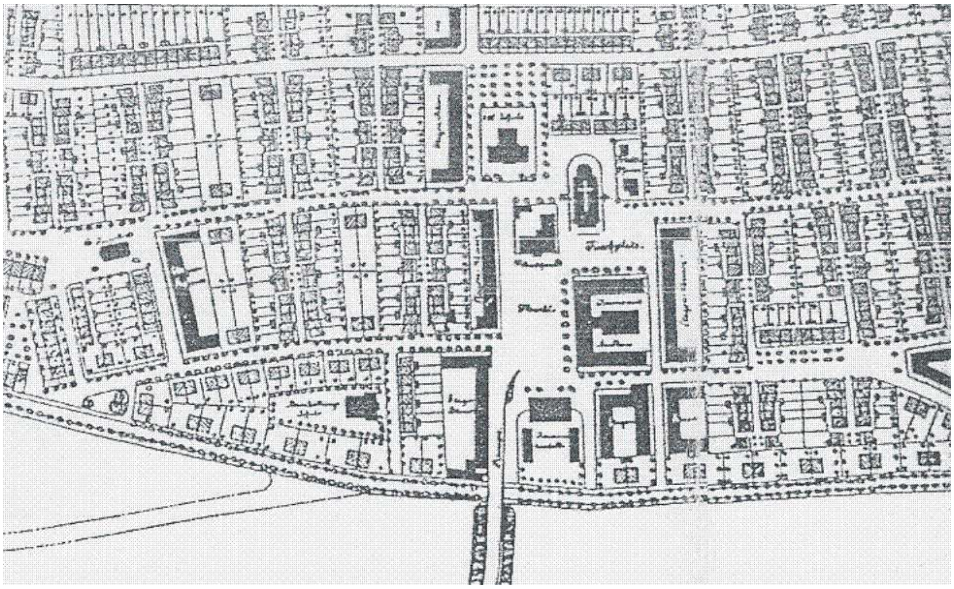

Fig. 2. Designed by K. Henrici in app. 1906 (source: K. Weissach, W. Machowsky. Das Arbeiterwohnungshaus, Berlin, 1910)

Henrici planned the settlement in the way that it would be possible to expand it as well as he foresaw the organisation of some recreational areas adjacent to the Settlement. In order to join the Settlement with the surrounding areas and make the expansion possible, Henrici planned the crossing roads up to the northern border of the Settlement. Minor streets with houses were weaved in to the frame of the main streets. They were originally planned not to be used for transport but to be used as safe places for children to play. Along the 100-meter-long street there were grouped from 20 to 28 single-family houses. Two-floor houses, apart from the market square, were also planned along the crossing roads which connected the Settlement with its outskirts.

Henrici applied various types of housing building including: detached, semi-detached and terraced houses. However, each of the houses was supplied with its own garden and outbuildings. They were designed in the rural style, as small, one-floor or two-floor houses with attics. Their scale and character referred to English "cottages" or peasant housing typical for the region. Each house was given an individual character through details. Eleven types of houses were designed, and the total number of 90 houses was erected. One type of houses did not survive to the present – it was the type of a two-family house.

Fig. 3. Settlement III for workers, 1905. Designed by K. Henrici (source: „Der Städtebau", 1906, Nr 6)

Fig. 4. Settlement III for workers, 1913. (source: K. Seidl, Das Arbeiterwohnungwesen, Kattowitz, 1913)

Settlement III in Knurów was erected in 1907-1919. Due to mining reasons, different area of location was selected for the Settlements (II Settlement for workers), Henrici's concept was not implemented. It remained only in the form of sketch design, a kind of guidelines, which further planners in Knurów referred to in their designs. It did not exclude further consultation with Karl Henrici. Some publications suggest that the author of the Settlement III for workers was Henrici himself, as well as the concept of the further extension of 1913.

Although Henrici's project was not completed in the form as proposed, he was undoubtedly the person who influenced the shape of the Settlement III for workers. The local version of the design was drawn according to his recommendations.

The plan of Knurów of 1919 finally shows the form and the extent of the realisation of Settlement III, which has been marked on the above presented plan with a darker colour.

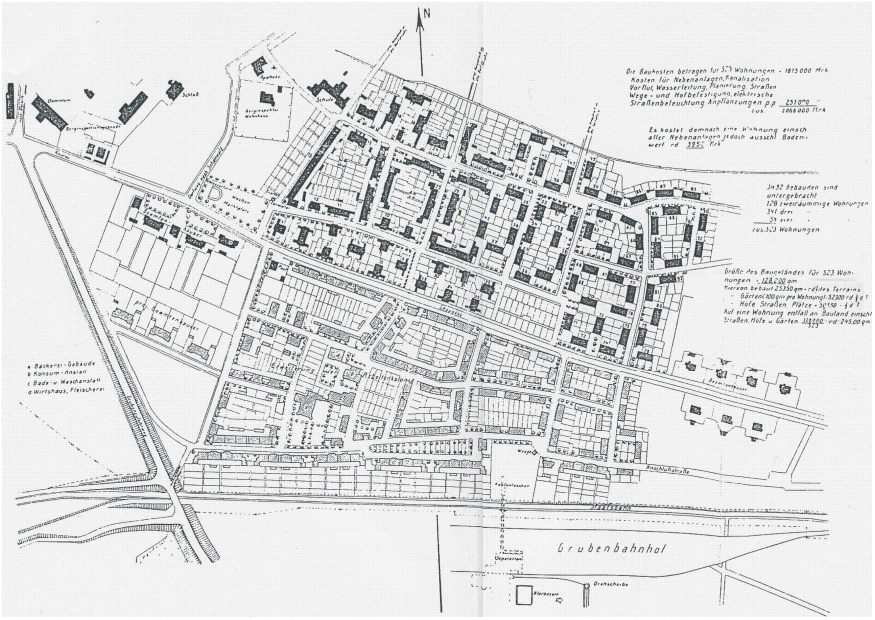

Fig. 5. The project of the Settlement to be implemented Repr. from: K. Seidl, Das Arbeiterwohnungwesen, Kattowitz 1913

3. CHARAKTERISTICS OF THE URBAN ARRANGEMENT OF THE SETTLEMENT IN KNURÓW

The current area of residential Settlement III forms an almost regular rectangle of approximate dimensions 550 m by 250 m. The construction of housing estate is defined by a network of six streets of the north-south direction and three streets of east-west direction. One of the streets "crosses" the whole area of the estate and is extended along the north-south direction, linking compositionally Settlements III and IV, and the whole residential area with the area of the mine, constituting the main vertical axis of the design. A distinctive feature of the system is the lack of straight sections of streets.

The introduction of winding streets aimed at increasing the picturesqueness of the settlement, and to avoid monotony. The internal communication in Settlement III was also designed as a system of pedestrian and driving lanes, with the assumption that the space would be also used as of space for children to play. The network of streets divides the estate into several different quarters. Houses are grouped in separate quarters, thus creating interior

courtyards. The desire to diversify the space is clearly visible. Each of the resulting quarters building has its own unique character. Each of the formed quarters of building has its own unique character. The differences between the western and eastern part of the settlement are clearly visible. The western part of Settlement III is characterized by greater regularity of the street system and the building line and by a more varied architecture. There are eight types of buildings (originally 9), while in the eastern part there are only two, very similar, types. However, the whole forms a harmonious combination.

There is no schematic urban layout, irregularly shaped network of streets, the gentle curves of streets, forming picturesque outlooks, the ends of the streets are closed with perpendicular walls of building, broken lines of houses - these are the features that made it possible to create a well-balanced urban interiors with a customized scale. The climate of small-town architecture is achieved by: spectacular views, the scale of development, and intimate urban interiors.

Settlement IV for the working class is different in nature from Settlement III. Together with Settlements II and I (for office for workers) they look more like a suburb of a Prussian town. In terms of urban planning, however, it is not a special value. The original plan for the southern part of the estate, assumed the development of this part of the estate which would be compositionally consistent with Settlement III. The implementation was not realised according to the plans, and the built part does not even have a complete centre of services. Settlement IV, partially built is not a fully "closed" and "complete" system. It is clear that its further development had been planned. There were attempts to supply this incomplete system in the western part with some sports fields – the original version assumed a pitch – now a stadium was built. However, neither then nor now the parts were or are connected.

Settlement II and I (for clerks) included a lot of privately-owned areas of greenery. Currently, such a system did not survive. The composition of the estate has been changed. Development was concentrated, utilizing these large gardens for new housing, which does not merge with the preserved historical buildings.

All residential buildings, at the time of their erection, were characterised by high standards and functionality. One of the features improving the living conditions was the toilets accessible, without having to go outside, from specially designed loggias. It was a great convenience for residents, as in the previous buildings for workers, such solutions were not used. The objects within Settlements for clerks and inspectors, the sizes of apartments were larger and their standards were higher. But even here there were several types of buildings: for clerks of the first and second categories were 2-family or 4-family houses

respectively. Houses for inspectors were single-family buildings. Settlement III in Knurów was designed as a settlement-garden with greenery playing an important role. In addition to the above-mentioned green backyards and front yards, the streets were lined with trees.

The intention was that the green areas would carry some compositional (greenery along the streets and green groups at their ends) and recreational (sports grounds) features. The public utility buildings were surrounded by generally accessible common green areas. Although the existing services: a school, the post office, a factory shop and the laundry, the whole premise lack in an organised centre with services.

4. BUILDING TYPOLOGY

The type of building in Settlement III for working class in Knurów is characteristic for a small-town. The parallels to this type of development can be found in the designs of such Silesian estates as: Giszowiec in Katowice, Rokitnica in Zabrze, or Settlement Załęska Hałda for working class. The inspiration for the building was a combination of the architecture of the Silesian countryside house and an English cottage.

Today, there are 13 basic types of houses in several varieties which can be differentiated in the Settlement. There was even one more type, but it did not survive to this day. The individual buildings differ in the plan, the shape of the roof or in the details (loggias, avant-corps).

Despite the large number of types of developments, the architectural uniformity was maintained in Knurów. This was achieved by using the same materials and thanks to the uniform character of the development. All the buildings are two-floor objects for four to 21 families. Driven by economic factors the idea to erect detached houses was abandoned. Each apartment for workers had a fairly large kitchen with the space for a sink.

It consisted of one or two bedrooms. It was also equipped with a veranda. Each of them had a separate entrance. Sanitary rooms were on the landing or in a utility room (located in the veranda). Housing intended for officials were larger. They are equipped with several bedrooms, a kitchen, a maid's room, a pantry, a bathroom and a hallway.

The housing estate ensured its citizens optimal and suitable conditions for life.

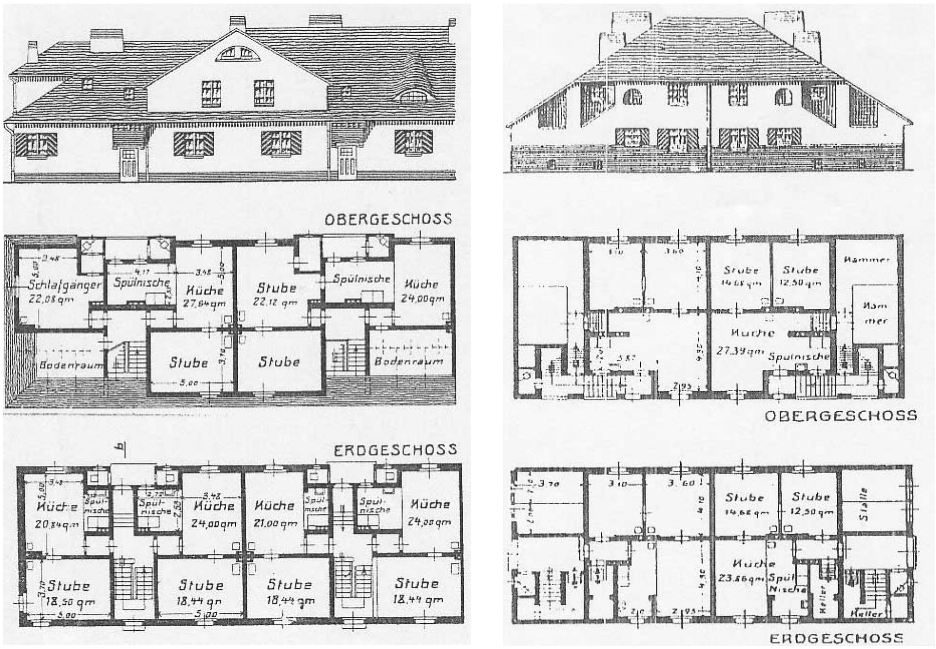

Fig. 6. Projects of various types of houses in the Settlement Knurowska - elevations and projections. Repr. from: K. Seidl, Das Arbeiterwohnungswesen, Kattowitz 1913

5. SUMMARY

Settlement III for workers in Knurów, although its implementation had not been completed, has had a huge cultural value in the whole region. This is the work of one of Europe's largest urban planners of the beginning of the twentieth century. It is the evidence of the enlightened thinking of shaping urban housing units. It seems that despite the passage of time, the manner and approach to the design proposed by Karl Henrici have been still valid. Henrici showed how to shape the space to favour the sense of identity of the inhabitants, bring out its advantages and improve the attractiveness and safety of the residence. The present condition of the Knurów Settlement is devastating. It is absolutely indispensable to immediately take the necessary measures in order to determine the possibilities of how to shape and protect it in order to preserve the cultural identity of one of the Silesian towns.

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WPŁYW IDEII KARLA HAINRICIEGO NA ROZWÓJ KOLONII KNUROWSKICH W LATACH 1904-1939

S t r e s z c z e n i e

Narastająca u progu XX w. migracja ze wsi do miast w poszukiwaniu pracy doprowadziła do powstania gęstych skupisk zabudowy, które w połączeniu z przeludnieniem i katastrofalną sytuacją socjalno-bytową wymusiła konieczność wznoszenia nie tylko przyfabrycznych zespołów mieszkaniowych, lecz całych osad robotniczych. Niestety osiedla patronackie tylko częściowo rozwiązywały potrzeby ówczesnego mieszkalnictwa. Wobec skomplikowanej sytuacji mieszkaniowej w miastach, urbaniści niemieccy starając się skutecznie rozwiązać problemy, chętnie sięgali po idee austriackiego planisty Camillo Sittego (1843-1903), który w projektowaniu (Sitte C., *City planning according to artistic principles)* zwracał uwagę na skalę architektoniczną, proporcje i występowanie elementów przestrzennych jak placów, terenów zieleni, a także na rozległość i odległość zabudowy. Koniecznością stał się również o ile to możliwe łatwiejszy dostęp do rekreacji, obiektów kultury czy obiektów usługowych. Zgodnie z tą zasadą zaprojektowano zespół kolonii w Knurowie, których rozwój przypada na lata 1904-1939.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

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MODERNISATION OF HISTORIC HOUSING COMPLEXES IN PYSKOWICE

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In an Upper Silesian town Pyskowice, there are three urban complexes: a historic centre with traditionally arranged medieval buildings, a housing complex built before World War II for the needs of railway workers and a housing estate built in connection with a planned vast industrial investment for its workers in the socialist realism times. The first complex was subject to the slow transformations related to the cultural changes characteristic for the European culture. Despite the dramatic misfortunes, its 13th-century origins preserved. The two remaining complexes were built as houses for new economic investments. At present, the communities of the estates face the problem of how to further develop the ideological remnants of the estates on their own. A problem of functional integration of the housing complexes, designed as separate ones, occurred. The modernisation works, related to the town development, refer to the fields of town planning and architecture. They also make it possible to observe the technical and technological advancements of the times they were erected. The presented examples of the modernisation works throw light on the cultural awareness of the designers and investors of the times and their understanding of the importance of the notion of surrounding. The newly arising architectural forms demonstrate an interesting reference to the local tradition and the existing forms.

Keywords: urban complexes

1. HISTORICAL BACKGROUND

In an Upper Silesian town Pyskowice, there are three urban complexes: a historic centre with traditionally arranged medieval buildings, a housing complex built before World War II for the needs of railway workers and a

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housing estate built in connection with a planned vast industrial investment for its workers in the socialist realism times.

The first complex was subject to the slow transformations related to the cultural changes characteristic for the European culture. Despite the dramatic misfortunes, its 13th-century origins preserved. The two remaining complexes were built as houses for new economic investments. At present, the communities of the estates face the problem of how to further develop the ideological remnants of the estates on their own. A problem of functional integration of the housing complexes, designed as separate ones, occurred.
The current development of Pyskowice is based on the Local Development Plan The observations of how the assumptions of the Plan are realised by specific investments allow the evaluation of their quality and usefulness to the communities. The modernisation works, related to the town development, refer to the fields of town planning and architecture. They also make it possible to observe the technical and technological advancements of the times they were erected. The presented examples of the modernisation works throw light on the cultural awareness of the designers and investors of the times and their understanding of the importance of the notion of surrounding. The newly arising architectural forms demonstrate an interesting reference to the local tradition and the existing forms.

The Local Development Plan provides a frame within which the specific investments are realised. The market economy should rationalise the investments in terms of their functions and the used construction technologies. The arising forms prove the cultural awareness of their designers and investors. What particular modernisation and developmental works in Pyskowice have been undertaken since the system changed in 1998? Is the rational, money-ruled economy beneficial for the residents, too? What forms, technologies and materials dominate in new investments? Is the reference made to the already existing forms clear?

Pyskowice is the town in Silesian Voivodeship situated 12km north from Gliwice. It transformed from a village into a town, thanks to its favourable location on the trade route Wrocław – Kraków, over seven hundred years ago. The route separated here into two directions: one to Częstochowa and the other to Kraków. The area of the commune takes 3.114 ha, out of which 1.693 ha is covered by buildings of an urban character.

The first documented information about Pyskowice comes from 1256. It describes the fact that Tomasz, Bishop of Wrocław, grants the tithes from several neighbouring villages to the church of St. Paul in Piscowiczych, acceding to the request to support brothers Lutozat and Lonek, Pisc's sons, the builders of the church. The historians assume that the City Rights were granted

by Władysław I, the Duke of Opole, probably in 1260. In 1532, after the death of Jan, the Duke of Opole, Pyskowice became the property of the Habsburgs. The elaborated then "urbariusz" (land register) informs us that there were 34 houses around the market and 63 ones in the surrounding streets. They were small, wooden and thatched with rushes or straw, placed on narrow plots. The town was surrounded by an earth embankment and a moat filled with water from the river Drama.

Two gates, Tarnogórska and Toszecka, were placed along the defensive fortifications. There was a wooden town hall in the market square. The population of the town was approximately 500 dwellers.

Numerous markets were held in Pyskowice due to the town favourable location on an important trade route.

The further development of the town took place in connection with thedestructions of the Hussite wars in the 15th century, the Thirty Years' War, including winning it in 1642 by the Swedish, the Silesian War II and the Seven Years' War. The subsequent destructions were followed by rapid recovery and further development of the town. The number of population of the town grew up to 1862 dwellers in 1787. Two charcoal-fired furnaces for pig iron smelting were built between the 17th and 19th centuries. After a tragic fire in 1822, which resulted in more than half burnt houses and public buildings, the reconstruction was carried out according to the plans restoring the thirteenth century system.

After World War I, Silesian Uprisings and the Plebiscite, Pyskowice were incorporated to Germany. An important event for the town development was a railway, built in 1898, which connected Gliwice and Opole. It was then that the housing estate for railway workers started to be built and the railway station started to be modernised.

For a short time, Pyskowice was a final station, and then it was connected to Gliwice, Zabrze – Biskupice, thus becoming an important railway junction. A systematic and planned modernisation of the station, carried out at the turn of the centuries, was ceased by the events taking place in the 1920s – connected with the Plebiscite and the Silesian Uprisings. During the 1930s and in the years of World War II, the extension of the marshalling yard was being built, of which western part was completed and eastern one was not completed. Simultaneously, the housing estate for railway workers was built.

While the damages after World War II were inconsiderable, the entry of the Red Army resulted in the destruction of 32 buildings. In March 1945, Pyskowice were taken over by Polish authorities. By the end of the 1940s the burnt buildings were restored and their historic arrangement was preserved.

On 5th of December, 1964, a 5-kilometre section of a road to the newly built railway station, Pyskowice – Miasto, was opened to the public. In June

1986, the first section of the rail Kolejowy Ruch Regionalny was commenced. It was planned to shuttle with a high frequency, just as it was organised in Trójmiasto, between stations Pyskowice and Mysłowice. The beginning of the 90's are characterised by the political changes in Poland, which caused a decline in rail transport and the closing down of unprofitable lines, Pyskowice railway junction including.

At the beginning of the 50s, the socialist-realism housing estate was completed. In the 80's, a bypass of the town was built, moving the transit transport in the direction Kraków-Opole out of the old town.

During the 70s and 80s, new housing estates were built with the use of prefabricated materials technology. The height and the layout of the buildings refer to the socialist-realism estate built in the 40s and 50s. Residential estates, as well as the factories and other urban infrastructure facilities were built according to the Local Development Plan.

Three urban complexes were formed in Pyskowice over the centuries:

1. Primary connected with the location of the town in a traditional medieval system, in a form of rectangular quarters with an oval ring, a town hall at the centrally situated market. The system, in spite of the vicissitudes of fate, wars, and changes in the construction technology was restored by a

conscious decision during the restoration works after the devastations in 1822.

2. An estate complex for the railway workers, which developed together with the railways set up in 1879. It was essentially expanded when the railway junction was being built in the 30s, before the World War II.
3. A socialist-realism housing estate, built in connection with the planned vast industrial investment, the existing neighbouring factories and mines as a housing estate for their workers.

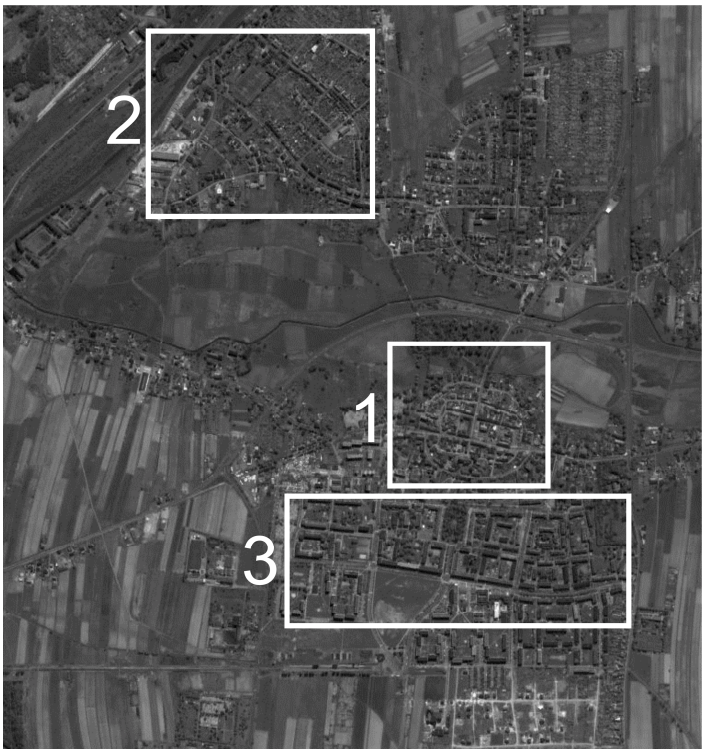

Fig. 1 Urban complexes in Pyskowice, 1 – the medieval system,
2 – the railway housing estate, 3 – the socialist-realism housing estate.

2. URBAN COMPLEX IN PYSKOWICE

The form of the first urban system was designed to surround the town with defensive fortifications. It entered the registry of historical monuments and thus was not substantially rebuilt.

The historical centre underwent natural, evolutional changes characteristic for the European culture. The dwellers experienced fires, wars, uprisings, industrial and social revolutions.

In 1882, after a series of 11 fires, when majority of buildings was burnt, a planned restoration of the town was commenced. The centre was decided to be rebuilt to respond to the new social needs; the historic layout was maintained, though.

The development of Pyskowice railway junction was accompanied with the construction of the housing estate for its workers. The vast advancements in the construction of the estate took place during the extension of the railway junction, in the 30s until the end of the World War II. The estate was planned along the road adjacent to the railway. Thus, there are railway facilities along one side of the road, and apartment buildings on the other side. The perpendicular access roads converge to form the main street, leading to the historic centre. Their curves are built-up with houses. The estate is stylistically homogeneous in parts realised up to 1945. The war interrupted its construction.

Fig. 2. Historic photograph of the market in Pyskowice.

The housing estate comprises three storey detached buildings with low-standard flats and attics transformed into flats, as well as small single-family terraced houses. There is an inconsiderable range of services. The buildings are of a homogeneous function. There are insignificant recreational areas next to the detached buildings.

After the World War II, in the 70s and 80s, a few housing complexes comprising multi-family four storey buildings were built. They were designed to follow the primary street plan of the town.

At the turn of 1946 and 1947, Joseph Stalin proposed Boleslaw Bierut to locate large metallurgical conglomerate in Poland. A special team, who was to decide on the location of the investment, took into account the area between Gliwice and Pyskowice, area near Skawina, the surroundings of Kopiec Wandy in Kraków as well as at the Vistula River Mouth.

Fig. 3 The medieval street plan around the town hall.

Fig. 4. Buildings in the railway housing estate (author's photo)

At the same time, the construction of a housing estate was commenced in Pyskowice. Undoubtedly, this design also took into account the expected needs of the existing nearby industrial plants. The estate was built in accordance with the principles of socialist realist architecture. However, the main building of the cultural centre or the committee house were not built.

Clear, due to the lack of the further investments, band street system, referring to the housing estates in England, richly decorated with neo-Renaissance architectural details, is equipped with all the basic utility functions. Closed quarters included green recreational areas inside, equipped with sandpits for children.

The estate provides higher-standard flats, thus realising the program of cohabitation of the working class and the working intelligentsia. The ideology behind it assumed class integration between the newcomers, including blue collar workers and managing staff, i.e. people who were directed by the authorities to work here.

Fig.5 Socialist realistic housing estate (author's photograph)

The estate provides a rich variety of town facilities, including health centres, schools, kindergartens, nurseries, retail, catering and services. The services have been situated in detached houses and on the ground floors of houses.

The first complex underwent a slow transformations connected with cultural changes characteristic for the European culture. Despite the dramatic misfortunes, its 13th-century origins preserved. Nowadays, the urban system around the town hall has been inscribed on the register of historical monuments. The two remaining complexes were abruptly deprived of their originally planned functions. The expansion of the railway junction in Pyskowice, continued after World War II, was then ceased, and in consequence it was

liquidated after the transformation period, in the 90s. Its functions were taken over by railway junctions in Gliwice and Kędzierzyn Koźle.

The industrial plants, which the socialist realistic housing estate was to provide the workers with flats, were not built. The existing plants: BUMAR Łabędy S.A. As well as HUTA Łabędy considerably limited the number of employees. All the mentioned above complexes, supplied with residential areas and the surrounding agricultural farm houses, constitute an administrative organism of the town of Pyskowice.

Formal transformations connected with the modernisation activities and the development after the system change in 1998 may be comprised in three groups of subjects:

- Town planning
- Architecture
- Construction techniques and technologies

3. TOWN PLANNING

1. We can observe a rapid growth of residential areas in Pyskowice. Each of the urban complexes is currently vastly exploited by private investors who erect new buildings filling up so-far empty plots, complementing street frontages and forming new ones.
2. New industrial investments are occurring similarly fast, including two logistic centres, a woodwork manufacture, a wholesale for baking industry, and a hydraulic fittings production plant.
3. The basic services are supplemented i.e.: a catholic church at the railway housing estate and a large shopping centre of a large network of international trade near the historic centre.
4. Attractive areas of the former arboretum were sold to a private investor more than 100 hectares of which were intended for residential houses with gardens, however, the implementation of this idea failed to commence.
5. A bypass of the town was modernised at the beginning of the 80's. The most collision cross roads (including the bypass and local roads) were rebuilt, and two others were provided with traffic lights. A petrol station was built in the proximity of one of them. A modern petrol station was built in the immediate vicinity of one of them.

4. ARCHITECTURE

1. The single-family houses demonstrated rich forms (in terms of the building projections and complicated roofs), which was characteristic for the first

years of the transformation period after 1998, then the forms began to be more modest. Simple forms with gable roofs started to dominate. Bungalows, without basements, are becoming increasingly popular.
2. Majority of buildings is erected on the basis of typical designs available in numerous catalogues. It results in very rich architectural forms but also causes a lack of recognizable local style.
3. The buildings comprised in the socialist realism housing estate become subject to systematic repair work. The inventory documentation is completed which may be the basis for further renovation and repair activities. Timber roof trusses are repaired and tails are replaced. The thermal-modernisation activities, related to the roof repairs, cover the details from the socialist realism times.
4. Private investors are adapting fragments of stylish socialist realist buildings to their needs shaping new forms freely.

5. CONSTRUCTION TECHNIQUES AND TECHNOLOGIES

1. The basic technology used in the construction of the walls of houses is a two-layer ceramic brick wall, insulated with lightweight seamless insulation. Extraordinarily, solar collectors and photovoltaic cells occur on the roofs.
2. Big-box stores and industrial buildings are arising as steel structures on footings, shielded with sandwich panels.
3. Roofing of the new sports hall at one of the schools has been based on large-spans glued wood trusses.

6. TRANSFORMATIONS

Despite the exceptional character of the three urban complexes in Pyskowice, they have undergone transformations, typical also for other towns, related with the repair and modernisation activities. The existing Local Development Plan organizes and facilitates the investment process. The conservatory protection of the urban system of the old centre results in a grater discipline as far as the investment decisions are to be made, compared to the socialist realist housing estate which is deprived of such protection.

1. The applied forms and technologies are typical for the modern solutions used all over the world. It is clearly visible that the developers are aware of the rationally applied materials and selected solutions.
2. Taking into account the fact that house projects are commonly searched for in nationwide catalogues proves that there is no need for exploration and cultivation of local architectural forms.

3. The buildings in the railway housing estate have been subject to modernisation works in the slightest degree, which results from their low standard, thus low market value.
4. The emerging industrial plants bring hope for increasing the citizens' wealth, which, in turn, may increase the quantity and quality of undertaken modernisation works.
5. The observed tendency of the rapid growth of suburban residential areas allows us to predict that Pyskowice will evolve to become a town with prevailing single-family-type buildings.

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MODERNIZACJA HISTORYCZNYCH ZESPOŁÓW MIESZKANIOWYCH W PYSKOWICACH

S t r e s z c z e n i e

W górnośląskim mieście Pyskowice, funkcjonują trzy zespoły urbanistyczne: historyczne centrum w tradycyjnym układzie średniowiecznej zabudowy, zespół osiedlowy wybudowany na potrzeby pracowników kolei przed II wojną światową oraz socrealistyczne osiedle mieszkaniowe powstałe w związku z planowaną dużą inwestycją przemysłową, jako zaplecze dla jej pracowników.

Pierwszy zespół poddany został powolnym przemianom związanym ze zmianami kulturowymi charakterystycznymi dla europejskiej kultury. Mimo gwałtownych zdarzeń losowych zachowało się jego XIII -wieczne założenie. Dwa pozostałe zespoły powstały, jako zaplecza mieszkaniowe związane z nowymi przedsięwzięciami gospodarczymi. Obecnie, społeczności osiedli stają wobec konieczności samodzielnego zagospodarowania pozostałości ideologicznego programu swoich osiedli. Zaistniał problem integracji funkcjonalnej, projektowanych, jako odrębne zespołów osiedlowych.

Działania modernizacyjne związane z rozwojem miasta dotyczą zagadnień z dziedziny urbanistyki, architektury oraz pozwalają obserwować ich ówczesne zaawansowanie techniczne oraz technologiczne. Przedstawione przykłady działań modernizacyjnych mogą dać pojęcie o świadomości kulturowej twórców i inwestorów oraz ocenić ich sposób rozumienia kontekstu otoczenia. Interesujące jest odniesienie powstających form architektonicznych do tradycji lokalnej oraz stosunek do form zastanych.

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SUCCESSFULL URBAN REGENERATION PROJECT: GDAŃSK-LETNICA DISTRICT CASE STUDY

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This paper presents the process of urban regeneration of Gdansk Letnica district, a project that from a very short time perspective can be described as successful. The paper will present a brief district's history as well as analysis of circumstances that may have influenced Gdansk authorities' decision of starting an urban regeneration project. The next part shows preparation of the urban regeneration project and its implementation. The conclusions take into account all aspects of the process, i.e. technical, economic and social.

Keywords: revitalisation, risk management, engineering of construction processes

1. DECISION OF URBAN REGENERATION

1.1. Historical background [2, 4, 7]

Letnica, after war also called Letniewo and before Lauenthal, as one of the first districts of Gdansk underwent, as one of the first districts in Gdansk, a thorough process of urban regeneration in 2010-2012. Origins of today's Letnica stem from beginning of 19th century (1803). This area, belonging to Cistercian convent in Oliwa, was then sold to the owner of Jelitkowo. Finally this are together with Zaspa lake became the ownership of the city of Gdansk and opening of railway between Gdansk Glowny and Nowy Port in 1867 resulted in dynamic development of industry and housing in this town, later to become a district of Gdansk. The factory of phosphate fertilizers, steel mill and rolling mill were created, to be followed by ironware factory and bottle factory. A

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workers settlement was built, in 1880 it occupied an area of 78 ha. Characteristic, fan-like network of streets was created, their names related to industrial plants located nearby. Archival photographs present neat, beautiful gardens and summertime plays by Lake Zaspa.

In times of Free City of Danzig in Lauenthal majority of inhabitants was of German origin. After the Second World War the population changed. Polish people came, resettled from Vilnius area and other areas incorporated into USSR after war, from central Poland and from Pomerania. Those were mainly workers and farmers from small towns. In the 1950s around 4 thousand people lived there. Unfortunately politics of Gdansk authorities contributed to gradual degradation of the district. Tenants not paying their rents and evicted from other districts were moved to Letnica. From 1970 the gradual degradation and liquidation of Zaspa lake had begun, it was converted into ash and slag landfill for CHP Gdansk. Landfill area was 30 ha. At the end of December 2005 almost 2 mln of sludge was stored there. According to municipal plans the settlement area was meant to become warehouse and industrial area, not keeping housing function. No refurbishment works were undertaken, however the tenant continued to live there. What is more economic transformation in 1980's and 1990's caused closure of many industrial plants. The district degraded, population dropped to 1.5 thousand inhabitants, unemployment and crime increased. This state lasted for almost thirty years.

1.2. Reasons behind decision regarding urban regeneration of Letnica

Letnica is an example of workers settlement, built at the turn of 19th and 20th century. In 2007 the population was 1627 inhabitants, unemployment reached 13%. Out of forty companies located there, seven catered to the needs of local community. More than a half of the apartments consisted of one room with kitchen. The buildings usually had roofs covered with single layer bitumen roofing membrane. Before the project began over 60% of buildings were from before 1918 and 30% was built in 1918-1944. Those buildings did not have sewage system connected to the sewage network and only 4% had local sewage. There was no gas supply and no central heating systems. Only 25% of apartments had toilets and around 17% had a bathroom and hot water. Despite the dramatical deterioration of the resources and the degradation of the natural environment, the historic preservation officer decided that both the layout of the streets and particular buildings deserved protection and required regeneration. [4]. Additionally, the unique charm of the district and the ambience of the small town were noticed and appreciated.

In 1997, Letnica District Council was established and it applied to the City Council for a Local Development Plan Młyniska-Letnica to be elaborated.

Yet in 2002 the plan was adopted, but the City Council was still uninterested in the area. There were a lot of such areas within the Gdańsk city boundries, which lost its original functions as a result of various transitions and were (and still are) endangered with total or partial degradation. This is only the decision of the stadium erection which triggered the commence of Letnica regeneration [2].

Fig. 1. Location of the Letnica district and the PGE Arena stadium.

In April 2004, Gdańsk City Council passed a resolution "Regeneration Program for Degraded Areas in Gdańsk – Local Regeneration Plan" which also included Letnica. The document included a long-term program of undertakings in spatial planning, construction, economy and social policy in order to overcome the crisis situation in Gdańsk districts and to create conditions for their further development.

Next, on 30th November 2004, the president of Gdańsk, Paweł Adamowicz, sent a letter to the President of PZPN, M. Listkiewicza, declaring willingness to participate in the Euro Cup 2012. The Department of Urban Panning, Architecture and the Protection of Monuments of the Magistrate proposed a locality for the future stadium. The plans included six localities within the town boundries: Letnica, „Czerwony Most", Święty Wojciech,

Szadółki, Klukowo and Nowe Miasto-Północ, presenting the advantages of the particular localities. The possible road developments and the distant from the town centre were taken into consideration, as well as the area ownership.

According to the elaborated plans, Letnica was recognised to be the district "best suited" for this kind of venture, since, apart from the advantages of the locality presented in Table 1, it was noticed that such an undertaking presents a unique chance for Letnica to be revitalised and for the neglected Gdańsk areas: Brzeźno i Nowy Port (Fig.1) to initiate their economic recovery.

In 2007, The Gdańsk Development Office prepared the "Analysis of Growth Opportunities" for Letnica, in which a project of the development of this part of town was presented for the firt time [2].

Table 1. Weaknesses and strengths of district Letnica [2]

Strengths	Weaknesses
Investment areas of 30 ha owned by the Commune which may be sold. Easy access to public transport and individual transport (Marynarki Polskiej street) Proximity of attractive recreational areas: beaches, the sea, park in Brzeźno, Fortress in Wisłoujście. Future proximity of the stadium.	A working ash landfill Poor aerosanitary conditions – significant dust-pollution. Poor building land (poor bearing capacity. High level of underground water, implying water-ground relations to be regulated. The lack of a technical infrastructure. Poor condition of the existing roads. The necessity of modernisation of the existing buildings. Buildings of production-storage functions dominating. Proximity of industrial areas to the east of the district boundaries. Dwellers with a passive attitude to life.

It was also noted that such problems as: threat of social pathologies, low level of education and initiative of the dwellers, poor state of environmental conditions and tourist attractiveness.

2. PROJECT OF URBAN REGENERATION OF LETNICA

The analyses carried out by Gdańsk Development Office were the bases for the elaboration of the main directions within the project of the district revitalisation. They included a project of modernisation of housing buildings as well as the public space, a plan to build new roads and a program to stimulate local dwellers. In 2008, it was assumed that the project would be realised by municipal units of GZNK (Management of Communal Real Estate in Gdansk), ZdiZ (Management of Roads and Green Spaces), as well as such municipal companies as TBSs (Social Building Association) and other entities subordinated to the Magistrate. A series of technical expertises and plans of renovations of 30 buildings as well as the street system were performed. The elaborated documentation allowed submitting a proposition to EU in January 2010 to revitalise Letnica with founds within the Regional Operational Program for Pomorskie Voivodship 2007 – 2013 [6]. The proposition was supported with both the district's historical values as well as the problems with technical and social infrastructures. The population of the area (12 ha) designed for regeneration amounted to 1137 people.

Each regeneration program is assumed to be directed onto the social-economic growth and to improve life quality of the local society on the areas of intervention. There is why the undertakings within the regeneration projects must include both investments and non-investment tasks [3]. The basic investment tasks were as follows:

- Overhauls of 29 residential buildings of a total area equal 11 292,68 m², out of which residential area amounted to 5 836,29 m² (together with appurtenant cellars and cells) and the areas taken by services and industry amounted 434,94 m²,
- repairs of semi-public spaces (interiors of residential quarters) of a total area 25 789,57 m², which included 1 680 m² of pedestrian paths and lanes,
- the rebuilding and modernisation of the library and gym facilities in the building of the primary school (total area of the rebuilt and modernised rooms is 414,9 m²),
- the adaptation, regeneration and rebuilding of the building of the former school for the needs of the dwellers' social activities („Dom Otwarty” total area 928,77 m²),
- rebuilding, construction and modernisation of the road sections together with the construction of a new and the rebuilding of the existing underground infrastructure as well as the construction of new road sections.

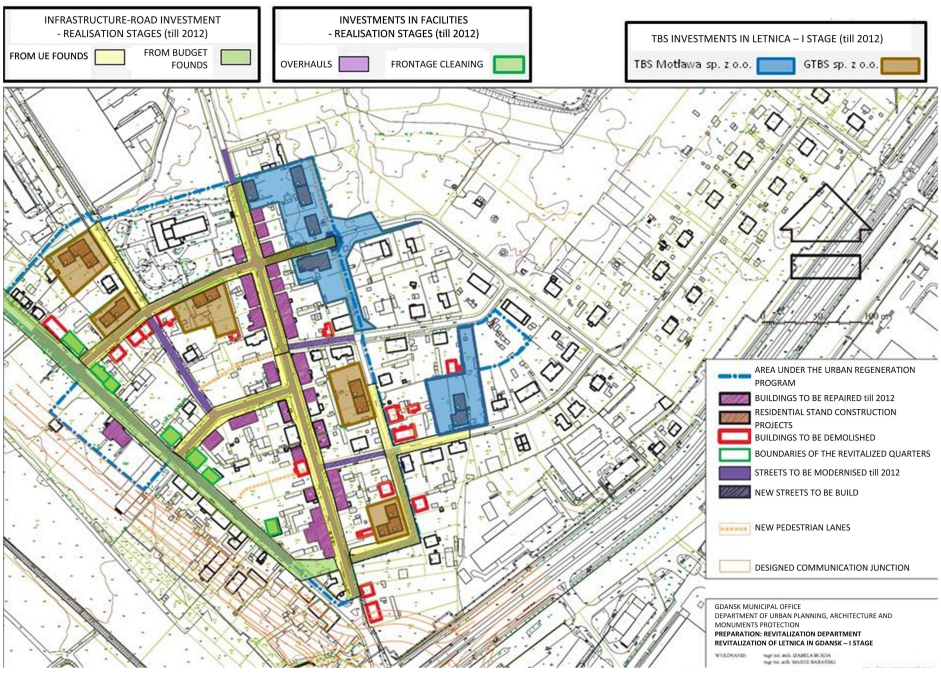

Fig. 2. Area under the Revitalisation Program [1]

Regeneration works included the demolition of parts of the buildings which were not eligible for repairs and modernisation. In such obtained areas, new buildings were planned to be built.

The Coalition established in 2009 for social revitalisation, which included nongovermental organisations, the perish, administrative municipal units and the President of Gdańsk, prepared a plan of social tasks (noninvestment). They included projectes such as:

– „Od ulicy do Euro 2012! – rewitalizacja społeczna mieszkańców dzielnicy Letnica" ("From the streets to Euro 2012! – social regeneration of Letnica inhabitants") – setting up a citizen's consulting centre and organisation of sport activities,
– „Integracja w Sztuce" („Integration in Arts") – artistic workshop for children and youngsters,
– „Nudo warsztaty lingwistyczo-taneczne" („Nudo linguistic-dance workshops" – linguistic-dancing workshop aiming to equal educational opportunities through foreign language classes and dance,
– „Klub Aktywnych Kobiet" („Active Women Club") – workshop for women

Social activities aimed to foster the dwellers' integration and to strengthen their social ties as well as to upgrade tourist and investment attractiveness.

In July 2010, the found was granted within PRO WP 3.2.1_1 and the district's regeneration process was commenced.

3. ORGANISATION OF THE REGENERATION PROCESS

The investment part of the regeneration was planned for 2010 – the half of 2012, and social tasks were palnned for eight years (2008 – 2015). The whole tasks within the project (the completed and the continued ones) have been coordinated by: the Department of Regional Programs in the Marshal's Office, the Regeneration Unit of the Department of Urban Planning, Architecture and the Protection of Monuments as well as the Department of Developing Programs in Gdańsk Magistrate.

With the extremely short time foreseen for the realisation of the investments (2 year), the proper scheduling of the construction works, and then reliable realisation of the tasks occurred to be a very difficult undertaking.
It is obvious that the more complicated and complex the tasks are, there are more problems with meeting all the requirements and keeping the deadlines and thus with the tasks coordination.

Letnica regeneration project assumed the cooperation between numerous economic entities. Apart from the formal participants of the investment part, there are numerous contractors of the particular tasks. Such a complex character of works occurred to be a great challenge in terms of the organisation of the whole undertaking thus resulting in the increased cost and extended duration of the implementation of the project investments.

Repair and modernisation works were performed in stages, but the short implementation time, limited with the Euro 2012, resulted in overlapping the schedules of building repairs with the schedules of road works. It caused a lot of disorders both in the works themselves and the evacuation of tenets for the time of the repairs. The road works often cut off the access to some of the buildings which were due to be repaired at the same time. Thre also occurred additional hazard resulting from the fact that building sites were visited by unauthorised persons, tenants including. It should be stated that some of the reasons resulting in the delays in the implementation works and the cost increase were impossible to foreseen as they were the effect of errors and mistakes made at the planning stage, while others were caused by “human factor” (negligence, omission, lack of competence, communication problems – delivering inaccurate or outdated information). There also occurred a lot of technical problems, among others:

– Scratches of walls in the repaired buildings, being the effect of the hardening of subsequent layers of pavements on roads in the building proximity,

– uneven settlement and deformation of the renovated buildings caused by the process of pressing piles into the ground being prepared for new objects in the buildings proximity; the technology had to be changed into a screwed piles technology (commercial tasks realised by GTBS Sp.z o.o. and TBS "Motława" Sp.z o.o.).

Despite the numerous mentioned above difficulties, in January 2012 the repairs and modernisations of all the buildings and roads were completed.

The regeneration works were also realised by TBS "Mołtawa" and GTBS Sp. z o.o. within their investment activities. They built eight residential buildings, containing 120 flats altogether, on the revitalised grounds. TBSs completed their activities in June and August 2012 and rendered the buildings for use.

4. ASSESMENT OF LETNICA URBAN REGENERATION

The regeneration of district Gdańsk- Letnica has been one of the recent largest investment realised in Poland. The evaluation of each regeneration processes, Letnica including, should be performed in terms of technical, economic and social aspects. From the technological point of view, the process was completed. However, subject completion of the project is planned for June 2015, and finance completion for August 2015. Thus, the comprehensive analysis of the town expenditures connected with the realised investments will be possible after their final settlement. It should be stressed that 70% of qualified costs i.e. 49,6mln PLN is due to be financed by EU, whereas the social regeneration process started together with the public consultations in 2008 and will continue yet for many years. It seems, though, that the success in this field may be announced now. All the repaired houses are occupied by tenants, and in summer 2012, 1st Letnica Congers took place which united all its native dwellers.

In the evaluation of the so-far achieved benefits, the following notation can be found in the Feasibility Study [3] elaborated for the needs of the project application for the EU founds:

„Realisation of the investment will contribute to series of social benefits. One of the most important ones is the growth of the value of the premises in Gdańsk Letnica. The comprehensive regeneration will improve the attractiveness of this part of town and in consequence result in the increase of the values of the premises. For the needs of the analysis, it was assumed that a standard flat is on average occupied by three tenants, and the values of premises are estimated to have grown by 25% . Such a high growth results first of all from the current unit rates, which are relatively much lower than in other

parts of the Town. Additionally, the area receives more promotion by the construction of the Stadium".

The expectations of the authors of the elaboration were met in 100%. Letnica regeneration together with the construction of PGE Arena stadium and Trasa Słowackiego (Słowackiego Street) – the connection between the airport in Rębiechowo and the Sea Port of Gdańsk (tunnel under Martwa Wisła including) resulted in the considerable growth of investment attractiveness of the surrounding areas. Shortly after the announcement of the decision of the organisation of Euro 2012 in Poland, Baltic Investment Group bought a land of 6.5 ha which was the former taxi base. What is more, the value of the premises in the are grew nealy ten times [5], which is expressed in the fees for perpetual use of land.

Taking into account the time pressure as well as the unique character of the project, Letnica regeneration project may be recognised as a success Technical problems have been overcame, social problems have been considerably reduced, and the economic benefits, measured with the level of social benefits considerably confirm the validity of introduced changes. It is particularly worth noticing that the dwellers were involved in all the social projects. It is this involvement which allows the global assessment of the regeneration project to be prognosed as a success.

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SKUTECZNY PROJEKT REWITALIZACJI NA PRZYKŁADZIE DZIELNICY GDAŃSKA - LETNICY

S t r e s z c z e n i e

W pracy przedstawiono proces rewitalizacji dzielnicy Gdańska-Letnicy, przedsięwzięcia, które z bardzo krótkiej perspektywy czasu można określić mianem sukcesu. Opisano historię dzielnicy oraz przeanalizowano wszystkie przesłanki, które miały i mogły mieć wpływ na podjęcie przez władze miasta Gdańska decyzji o rewitalizacji. Następnie przedstawiono przebieg procesu przygotowania projektu rewitalizacji jak i przebieg realizacji inwestycji. We wnioskach zwrócono uwagę na wszystkie aspekty procesu rewitalizacji, tj. techniczne, ekonomiczne i społeczne oraz ich wzajemne powiązania.

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SELECTED PRACTICAL AND METHODOLOGICAL ASPECTS OF RENOVATIONS AND ADAPTATIONS OF MODERNIST BUILDINGS FROM THE AFTER-WAR PERIOD IN UPPER SILESIA

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At the beginning of the economic transformation in Poland, buildings constructed after 1945 were treated as symbols of an unacceptable system. Currently, the modernist architecture of the twentieth century is seen as an important element of historical and cultural heritage. However, the problem of its protection against a number of adverse events that may lead to the loss of its essential values and often result in its destruction has been recently growing. The spectacular examples include demolition of the railway station in Katowice (built in 1964-1972) or the reconstruction of a part of the historic structure forced by the protests of various parties. Therefore, the authors attempted to identify the key factors for determining the assessment methods of modernist buildings, and to find possible ways of their transformations. At the same time, it is essential to indicate the significant risks that result both from the lack of understanding of the needs to protect the selected objects (erected in this period), and from the problems that result from the current legislation.

Keywords: modernist buildings

1. INTRODUCTION

The main reasons for which the post-war architecture has become the subject of thorough analysis of the degradation or even destruction of a number of objects recognized by a great number of historians of architecture as cultural heritage. On the other hand, it was necessary to adapt the remaining facilities to the requirements of the modern user. This includes the comfort of use, the changes of functionalities due to new needs as well as the transformations

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resulting from the fact that the buildings have to be adapted to meet the requirements of current safety regulations and usage standards.

Fig. 1-2. The negating attitude - Katowice Railway Station, designer Waclaw Kłyszewski, George Mokrzyński, Eugeniusz Wierzbicki, Waclaw Zalewski, 1959 - 1972, state of 2010 (photo on the left), demolished in 2011, the renovation of a part of the "cone" structure in the "railway station gallery" - new shopping centre formed in place of the railway and bus stations, 2012 (photo on the right). Photos by. R. Nakonieczny.

Fig. 3. The beginning of the demolition of the Railway Station in Katowice (photo by R. Nakonieczny 2010).

Fig. 4. Former House of Silesian Scientific Institute in Katowice, designed by Stanisław Kwaśniewicz, 1972.

The most important aspects to be considered in the project activities relating to the objects of the years 1945 to 1989 should include: the formal and compositional values, functional and structural values, material and technological values, historical and cultural values.

While in the case of protection of cultural heritage, one of the first elements of the assessment is a criterion of oldness, (time of origin related to the specific cultural context of a particular area), in the case of post-war buildings it is not perceived as a significant factor, mainly due to the seemingly small time distance separating us from the inception of the analyzed objects; hence the lack of understanding for the use of the term "monument" when the modernist buildings are referred to. Therefore, when we demand protection, we often refer to other elements of the analysis of the work. These are mainly the analysis of the form of the object, which we evaluate in terms of stylistic features typical

for the era, its artistic expression, its location (uniqueness) in the area. The second element is the composition in relation to the object itself but also its importance in the landscape (individual or complex). The third element is the function which we consider not only in terms of its adaptability to current requirements, but we are also looking for innovative solutions or the ones which are characteristic of the period when it was in use. Then we investigate structural values, relating them primarily to the construction of the object (assessment in terms of a traditional versus innovative structure when it was erected).

The material and technological values are considered, inter alia, in terms of the type of the construction technology, building materials and finishing. There is an element of authenticity as the value which may classify the object to be protected by the historic preservation officer. While for the assessment of the object it is important to consider the number of similar objects (frequency of occurrence), the originality of applied solutions or its uniqueness, in the analysis of modernist buildings it should be considered that some of them may be based on "typical projects", but they may present a significant value for their scarcity.

Fig. 5-6. The attitude of the partial acceptance - the Department of Civil Engineering Laboratory, Silesian University of Technology. Designed by Professor T. Teodorowicz-Todorowski (1973), Elevation before and after thermal insulation in 2012. Its project, completely obliterating the original features of the building, although obtaining a building permit, the attorney of the Academic District, Dr. G. Nawrot, protested thanks to which the building has partially retained some features characteristic for modernism. Unfortunately, the elevations have lost their original avant-garde character. Photo by R. Nakonieczny 2012.

Fig. 7-8. The attitude of full acceptance – a sports hall "Spodek" in Katowice, designer M.Gintowt, M.Krasiński, A.Żórawski, A.Włodarz, W.Zalewski, 1960-1972. At the end of March 2011, modernization work was commenced (Figure on the left). The first project was commissioned by MOSiR and was rejected after the intervention of the Chamber of Architects and the provincial authorities who intended to favour projects which would preserve the historically well-established form of the building. In Figure on the left – the commence of the work, which resulted in protests – in this case: cladding the exterior terrace with a layer of polystyrene (!) designed in the „béton brut" aesthetics. Photo by R. Nakonieczny 2011.

In case of the analysis of historical and cultural values, we refer to a number of aspects. An important factor is the credit of the facility – it should be verified how much the designer or the team of designers are significant for the development of architecture or engineering. In some cases, through the thorough analysis, it is possible to classify the object as a recognized work of architecture, urban planning, construction and engineering (domestic and foreign literature, prizes).

The analysis should also include the historical and symbolic values (historical events associated with the object, relationships with characters that are important to the culture and social life, the object as a symbol in social terms). Wide possibilities of transformations or liquidations can only be considered only in relation to objects of little significant values in each of these aspects.

2. FOUR MAJOR MODELS OF ATTITUDE TO THE ARCHITECTURAL HERITAGE

Professor Andrzej Niezabitowski defines four major models of attitude to the architectural heritage:

1. **elimination-arrogance-denial**, liquidation, destruction, deletion from memory;
2. **ignorance or passive tolerance –** acceptance of the material existence of the building;

3. **acceptance (selective or full)** of modernist architecture object;
4. **creative continuation –** creative development of cultural values of the architecture of the objects.

Fig. 9-10. The attitude of full acceptance – the theatre in Rybnik, designer J.Gottfried, H.Buszko and A.Franta, (1958-1964). State before and after modernisation in 2006 designed by J.Wawrzyniak. Full respect for the historical value of the object. The project included the preservation of a number of details such as the floors which retained their original form (i.e. broken slate floors) or Marian Rak's fresco adorning the entrance to the auditorium. Photo by R. Nakonieczny.

3. THREATS TO THE MODERNIST ARCHITECTURE

Threats to the modernist architecture of 1945-1989 include:

1. **Moral ageing** – process connected with social changes and technological developments resulting in the fact that property no longer meets the standards of use. This problem comprises adaptations to the current legal requirements.
2. **Technical ageing** – process of materials and construction technical wear. This particularly refers to the problem of low quality of materials used in the construction or materials containing substances which are currently considered to be harmful (asbestos, slag, chemical additives in fibre boards, etc.). In the case of experimental solutions, technological shortcomings are frequently found after several years of exploitation. Often, especially in relation to the reinforced concrete structures, drawbacks resulting from the lack of technological regime resulted from the deadlines politically conditioned.
3. **Unprofessional transformation** includes reconstruction leading to the loss of historical value of the object (loss of stylistic features, changes obliterating elements characteristic for stylistic doctrines ...). This comprises

project activities based on the ideas of “humanization of the object”, “fitting to context” “aesthetic improvements” “embellishment”

4. **Ideological depreciation** – object evaluation from the perspective of the political and ideological conditions in which it was created.
5. **Relativism –** the phenomenon of assigning significant ratings which are not based on a legitimate subject knowledge, the prevalence of Internet entries.
6. **Ignorance and denial –** assessment through the prism of shallow and commonly understood "aesthetics", a lack of understanding of the modernism as an artistic direction and its ideological assumptions. This applies not only to the assessments made by people not related to architecture. Unfortunately, there are frequent cases of devastation modernist objects with the approval of historic preservation offic.
7. **The legislation,** which creates conditions for negative transformation of objects. This is particularly true for thermal modernisations – based on the Act of 18 December 1998 on the support for thermal modernisations (Journal of Laws of 1998, No. 162), which in many cases extremely adversely affect the condition of the modernist heritage. This is due to the erroneous assumption that the energy balance of the building is seen in the act as a value superior to the cultural values of the modernised object. The Act imposes audit on the author of a construction project, as a mandatory guideline, which, in the absence of conservation protection, frequently results in devastation of stylistics and the designer acts on the edge of ethics and professionalism.
8. Pauperization – a phenomenon that covers a wide spectrum of problems, especially subjects relating residential areas. For the use of the paper we will restrict the definition to a process of degradation of architecture in which a part of an object is transformed by a single user or tenant. In Poland, the ownership policy favours such activities since it assumes the sale of individual units to their current tenants, and the fragmentation of ownership and the ignorance of the property managers favour these procedures. Local authorities depart lawsuits brought before the court by bodies set up to protect urban spaces (including the municipal offices of the departments of architecture, urban maintenance ...) referring such cases as replacement of windows which do not follow the original divisions, “small” reconstructions, arbitrariness in the insulation, colour or detail destruction ...
9. **Devastation –** a phenomenon that mostly affects abandoned buildings, parks, monuments, sculptures and landscaping.


Fig. 11-12. The attitude of the creative continuation – adaptation of an academic canteen No. 2 in Pszczyńska Street into Student Cultural Center Mrowisko in Gliwice. A typical project by prof. T.Mańkowski and prof. K.Lenartowicz carried out in the 70s (the second object based on this project is located in Łużycka Street in Gliwice). 2010-2011 – reconstruction of the Cultural Centre, according to the design by prof. J.Witeczek and T.Wagner. The state before (2005) and reconstructed (2011) [I]. Photo by T. Wagner.


Fig. 13-14. The attitude of creative continuation – the reconstruction and extension of the Department of Organization and Management at Roosevelta Street 32 in Zabrze (former Military Command Replenishment). The design of the building sygn.1973 WBP, reconstruction 2006-2011, the authors of the project J.Witeczek, G.Nawrot, T.Wagner. The state before (2005) and reconstructed (2011)[II].
Photo by T. Wagner.

[I] Within the rebuilding the function and the spatial arrangement were completely changed. The solid of the original facility was maintained; the interior uncovered, the formerly covered, interesting reinforced-concrete and steel structure of the building. The facility won the first prize for "The best public Space in Silesian Voivodship (13th edition of the competition, 2012)"

[II] The facility was granted an award in "The best public Space in Silesian Voivodship (13th edition of the competition)".

4. CONCLUSIONS

In several high-profile cases, scientific society initiated activities supported by the social movements brought back positive results in the form of either the protection of cultural values by inscribing them into a register of monuments, or changes in the method of carrying out the modernization and adaptation processes, as well as changes of projects to be implemented. This allows us to hope that social participation, which is a phenomenon characteristic for stable democracies, has started to grow in Poland.

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WYBRANE ASPEKTY PRAKTYCZNE I METODOLOGICZNE RENOWACJI I ADAPTACJI OBIEKTÓW MODERNISTYCZNYCH Z LAT POWOJENNYCH NA TERENIE GÓRNEGO ŚLĄSKA

S t r e s z c z e n i e

U progu transformacji gospodarczej w Polsce budynki wzniesione po 1945 roku traktowano jako symbole nieakceptowanego ustroju. Obecnie modernistyczna architektura XX wieku jest postrzegana jako ważny element spuścizny historyczno-

kulturowej. Tymczasem w ostatnich kilku latach nasila się naglący problem jej ochrony przed szeregiem zjawisk niekorzystnych, które prowadzą do zaniku jej istotnych wartości, a często unicestwienia. Do spektakularnych przykładów należy rozbiórka Dworca Kolejowego w Katowicach z lat 1964-72 i wymuszona protestami różnych środowisk rekonstrukcja fragmentu historycznej struktury. Stąd próba określenia podstawowych czynników pozwalających określić metody oceny obiektów modernistycznych oraz możliwe drogi przekształceń. Jednocześnie należy wskazać istotne zagrożenia jakie wynikają zarówno z braku zrozumienia dla konieczności ochrony wybranych obiektów tego okresu, jak i problemów jakie wynikają z obecnie obowiązującego ustawodawstwa.

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PROBLEMS OF RESTORATION OF WINDOW FRAMES IN THE 19TH CENTURY INDUSTRIAL FACILITIES ON THE EXAMPLE OF ŁÓDŹ

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The introduction to the historical window frames in industrial facilities presents the historical background. The issue will be discussed on the example of 19th century industrial facilities, as well as in the context of the solutions applied in other European countries. The characteristic of a standard factory window is presented on the basis of a typological analysis. The evaluation of the values of historical metal windows is the key point for the issue if and how original historical window frames should be protected. The importance of window frames for the recognition of a given historical monument as an industrial facility should be raised in the first instance. It is also important for the local identity. The degradation of the windows and their numerous drawbacks counteract their aesthetic and technical values. The paper discusses the main conservatory issues related to historical metal windows as well as the possibilities of treating them in light of adaptations of post-industrial buildings and the requirements of the current building standards. The methods of the repair and protection of architectural metal elements or their replacement into new ones will be discussed on the example of solutions applied in buildings adapted to new functions, in Lodz. The paper also presents windows with historical references available on the market.

Keywords: window frames, post-industrial objects, Lodz (Łódź), postindustrial heritage, window maintenance.

1. HISTORICAL BACKGROUND

The origins of window frames in Europe date back to medieval metalsmith craft, when simple, unopenable window frames, filled with stained glass, were forged. Extremely expensive metal windows were applied only in temples or residences

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of distinguished people until the sixteenth century, when the window frames began to be used also in secular buildings.

In the eighteenth century, with the industrial revolution, iron processing moved from forges to factories, where iron began to be cast in identical forms and controlled conditions. It enabled manufacturers to cast stylised products in a variety of forms. They started to cast arched-shaped and slim frames with T-shaped sash bars which were then glazed. Glass sheets were then fitted and sealed with putty[1]. In this period, however, only the window wings were usually metal, the frames, into which the windows were embedded, still remained wooden.

In the second half of the eighteenth century, metal window frames with a universal appearance began to be used in many types of buildings, from residential, through industrial (factories and warehouses) to public utility buildings and representative buildings[2]. Iron was desirable for its fire resistance (important in factories and plants experiencing frequent fires), as well as its strength, providing security in places like factories, insane asylums or orphanages.

The use of window frames did not become common in the United Kingdom until the turn of the eighteenth and nineteenth centuries. It was possible thanks to the rolling technology derived from the metal industry, which in turn, enabled the mass production of windows and lowered their prices, which meant that they could compete with timber windows[3].

The success of window frames was due to the cheap and fast production and standardization. In addition, they were easy to transport and the production process enabled performing a wide variety of light forms that resulted in brighter and better-ventilated interiors. Durable frames allow the use of large glazing, and combinations of multiple windows, which completely changed the style of buildings designed in the early twentieth century and later. Window frames of inconsiderable thickness were crucial for, inter alia, Art Nouveau and modernist architectural styles. The popularity of steel-framed windows did not

[1] The development in technology allowed architects to experiment – in 1750 James James Gibbs palced copper windows in the town hall of Warrington, and John Carr applied iron window frames in Wentworth Woodhouse in Yorkshire.

[2] The first fire resistant factory (Williama Strutt's cotton factory in Derby, 1792) had iron window frams.

[3] The 19th century was rich in discoveries and improvements in iron processing. Yet in 1820, metal windows were applied in housing construction. In 1856 Sir Henry Bessemer elaborated the first industrial method of steel production. Great Britain was then the world leader steel producer. Steel started to be commonly applied in construction industry in all Europe.

decrease until the 70s of the twentieth century, when it was superseded by frames made of aluminium, which is cheaper and does not rust.

2. TYPOLOGY OF WINDOW FRAMES ON AN EXAMPLE/BASIS OF THE NINETEENTH-CENTURY INDUSTRIAL BUILDINGS IN ŁÓDŹ

The present work examines steel windows in industrial buildings in Łódź, produced between the mid-nineteenth century until 1945, in terms of their typology. Factories built in Łódź in this period were similar to industrial facilities built in other European countries in terms of technological, functional and structural conditions. For the analogy in the window production, the discussed solutions may be regarded as universal.

The appliances and machines used in spinning mills generated large amounts of heat, so the problem of thermal insulation of windows was not considered. The overall temperature in the factory and was high enough, not mentioning the fact that the working conditions were neither regulated by any norms nor supervised. On the other hand, the fact that the windows were not hermetic even provided natural ventilation of rooms.

Fig. 1. Original windows in Scheibler's plant with the remains of accumulated cotton threads. Photo by W. Wiśniewska

The characteristics of typical window frames in factories in Łódź:

1. round-top windows (regular arches) on the ground floor,
2. segmented round-top windows (segmented arches), upper floors,
3. frames with small divisions and proportions of a vertical rectangle

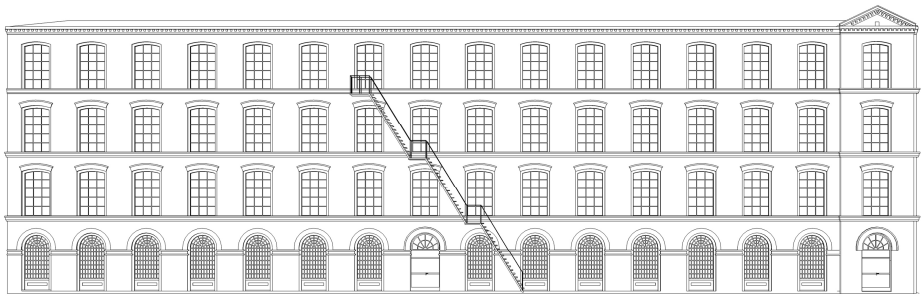

Fig. 2. An example of a typical façade of a textile factory in Lodz. Author: A. Kurzac.

Characteristic features of the factory windows from the late nineteenth and early twentieth centuries were determined by the manufacturers' main requirements, i.e.: minimum costs and fast pace of construction.

- The shape of window frames. The windows were usually round-topped with a full arch (on the ground floor) or segmented arch (on upper floors). The windows constituted 30% of the surface of the elevation. Later, they took a rectangular shape and their surface became greater.
- Fitting a frame into a wall. A frame was fitted into the wall at the stage when the wall was being erected which resulted in the fact that it is now very difficult to dismantle it without damaging either the wall or a part of the frame.
- Technology and materials. Prefabricated steel profiles replaced the woodwork and cast iron frames due to low production costs, lightness and durability while maintaining small cross-sectional profiles.
- The typical thicknesses of the elements. The external frame of the thickness of about 4 cm, is often completely hidden in the wall. The sash bars, both lateral and vertical are made of app. 2-cm-thick T-shaped profiles.
- The sizes of glass. Window frames were divided into smaller fields which were then glazed with small-size glass sheets. The cost of even a large number of small glass-sheets was not high in relation to large glass sheets. Moreover, if the window was broken, its exchange was neither difficult nor costs consuming[4].
- Ways of opening the windows. The elaboration of a window with a system for window opening had always been difficult. Therefore, only a single partition of a window was openable. Typically, an additional smaller frame

[4] Most typical sizes of glazing in Lodz factories range from 17x21 and 18x23 (Tabacco Company Tytoniowy), through 19x25 (OFF Piotrkowska), to 20x35 cm (Art Center). Galzings larger than 50x55/ 60 prove that the frames were replaced in the post-war period.

or joints were installed in a large window frame, which served as a system for window opening. Sometimes, the window was supplied with a hinged wooden frame.

The advantages of industrial metal windows included primarily those that conditioned their common and universal use in the nineteenth and twentieth centuries. Frames were cheap and easily fabricated in bulk quantities. In addition, they could be produced in a wide variety of forms. Frames were light and thus easy to transport. Frames with small multiplied divisions enabled production of very large windows which resulted in bright, well-ventilated interiors.

Among the most serious drawbacks of the historic metal windows include their noncompliance with modern standards of thermal insulation. Old frames are not moisture-resistant, so in winter they were covered with ice since the interiors were not heated[5]. When neglected, the windows may be subject to various types of damage, including::

- corrosion,
- mechanical and structural damages: warps, distortions,
- defects or cracks, destroyed joining elements,
- glazing and putty cavities,
- excessive multiple painting, peeling and loss of coating (paint),
- defects in the window joinery (broken hinges, handles),
- destabilization of window fittings in the wall.

Fig. 3. Various types of hinged frames used in industrial windows. From left: Scheibler's factory, Kretschmer's spinning factory, Geyer's weaving factory. Photo by A. Kurzac

[5] In the case of cast iron, the cast may be faulty due to the imperfections of the production process. The excessive fragility of the elements may result from the excessive amounts of phosphor in the iron or excessive cooling of the cast elements.

3. THE MAIN PROBLEMS OF HISTORIC METAL WINDOWS PRESERVATION

The protection of the elements of historic buildings is an obvious and basic assumption of conservation etc. Windows carry the data on historical technologies, craftsmanship, materials, etc. In a protected property, in which the appearance of windows indicates its character, window frames determine the style of the building and shape the climate of both the façade of the building and of its interiors. Thus, the windows themselves may be considered to be of historic value. The change of old windows has an undeniable impact on the change of the image of the building.

The windows are elements which are particularly vulnerable to destruction and ill-treatment. They are easy to be removed and commonly believed to be impossible to be properly repaired. Thus, this view results in the historic windows end up massively in landfills. When a building is adapted to the new functions, it is usually expected to meet the new standards of thermal and acoustic insulation - the fate of existing windows almost in advance is doomed.

Fig. 4. An example of a building where an uncontrolled replacement of window frames led to the complete loss of the original aesthetics. Photo A. Kurzac

4.1. Selected renovation and adaptation procedures connected with original window frames on the examples of their usages in Łódź.

1. Preserving the original frame. Repair, seal and proper exploitation.
   - Karol Scheibler's factory Łódź Art Center
   - Adolf Kebsz's factory of knitted materials, Old Sewing Club
   - Franciszek Ramisch's factory complex, OFF Piotrkowska
2. Preserving the window exterior, the installation of double glazing or mounting a composite window from the inside.
   - Ludwik Geyer's "Biała Fabryka", Museum of Textiles, wing B
3. Removing the original frames from walls and leaving them as a witness on the property area.
   - Ludwik Geyer's "Biała Fabryka", Museum of Textiles, wing D
   - Franciszek Schweikert's factory, Łódź University of Technology, building of WTiMS
4. The replacement of a whole window – restored with the use of modern technologies
   - I. K. Poznanski's Spinning, Andel's Hotel,
   - Eitingon's Factory, Office Center,
   - Muehle brothers' Spinning, offices and corporate headquarters,
   - Józef Balle's Factory, the seat of Gazeta Wyborcza.
5. The replacement of a whole window – forms of new windows are inspired by historical solutions:
   - Franciszek Schweikert's Factory, Łódź University of Technology, building of WTiMS
   - Edward Bormann's factory of silk and woollen gloves, Zenit
   - Adolf Dauby's factory, Synergia Business Centre
   - Karol Steinert's factory, Milionowa Residence

The most appropriate procedure is, of course, current, cyclical maintenance of the original frames. The authentic character and the integrity of a building are preserved and the owner of the historical building avoids expenses on window replacement. In the case of the adaptation of the building, it is unfortunately the least common procedure, usually understood as a temporary measure taken before the proper window replacement, due to the lack of funds. So, it is advisable to analyse the real possibilities of repair, strengthening and sealing the original frames.

4.2. Methods of repair of metal window elements

Metal windows may be renovated *in situ* – in a building site, or in a workshop after they have been removed from walls. Unfortunately, it is often too dangerous or even impossible due to their tight attachment to the wall.

In the considered case, in Lodz factories, the removal of frames involved partial demolition of walls (without damaging the frames),

The renewal of ungalvanized metal window frames (iron, iron cast or steel) involves the removal of old paint and rust, and then the appropriate protection of their elements. There are numerous techniques for removing rust and the top layer of paint. From the simplest and cheapest methods, such as hand scraping and chipping or brushing the surface to the more advanced and more precise methods of removing rust and paint, such as: rust removal by acid etching, blasting (sandblasting), cleaning with oxy-acetylene flame or propane-oxygen (in the case of wrought iron), to the exchange of a part of a frame. In the latter case, the rusted part is cut out and then the frame is complemented with elements made of the same material which are welded [7].

4.3. Techniques for sealing windows

One of the best and least invasive ways to achieve higher thermal efficiency of windows in old buildings is to install the seal. It is available in several forms, each of which has a different effect.

Some are simple joint fillers applied as mastic or foam. Other forms provide the isolation through convenient, ready-made constructions, which are so versatile that they can be adapted to any type of window. Cheap products "do it yourself" products survive ten years, while those of better quality at least twenty years. Good seal should not only insulate but also be durable and present some aesthetic values. Professionals may both renovate and simultaneously seal the window providing good value for money services. The investment will bring fast returns thanks to the energy savings, thermal comfort and the exclusion of noise and dust [10].

4.4. Installation of an additional glass sheet or a composite window

The original window may be left *in situ*, even if its technical condition forecloses its repair, through preserving an external window and the installation of an additional internal division. If the window survived to the present day in good condition, it is even better, because we receive a double protection from the weather.

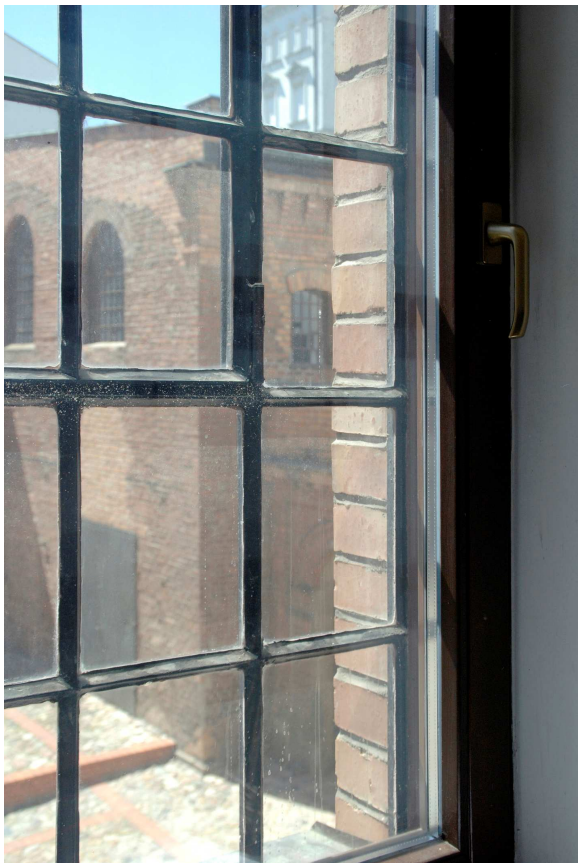

Fig. 5. Example of the installation of an additional window. Ludwig Geyer's "Biała Fabryka" (now Central Museum of Textiles), Łódź. Photo by A. Kurzac.

There is a possibility of supplying the window with additional glazing along the perimeter of the window wings or doubling the number of wings, or finally, the installation of the additional glazing of the whole window opening from the inside or also providing an additional contemporary window. In many cases, introducing an additional glass sheet is a cheap, workable, and much more appropriate alternative to the installation of closed double-glazed units. It may be removed, allowing the original window to operate normally. It also solves the problem of heat losses and air streams passing through the leakage at the edges of the glass. Unfortunately, an additional glass sheet is not a popular option in Poland. The installation of an additional glass is merely an auxiliary, which may not be sufficient when the original window is in poor condition, but if connected with the renovation and repair, the results may be surprisingly good.

4.5. Replacement of windows

Preservation and restoration of historic elements should always be considered in the first place as the best option of conduct. Unfortunately, in many cases, the metalwork is so destroyed that it is not possible to be repaired or maintained effectively. It also should not be assumed in advance that each window proves the rank and aesthetics of the object, and thus does not have to be protected at all costs.

When replacing the windows with new ones, there are numerous problems which need to be resolved: low stiffness of profiles, which, with a considerable height of the window, imposes the use of considerably thick elements, the limited ways of window openings, not to mention the inconsideration of such details as glazing, fixing or handles.

While deciding on the window replacement, best solutions need to be applied that combine modern design with historic looks. Manufacturers' offer is really wide, but only single products are close to historical aesthetics. It should be emphasized that windows made of super-slim profiles and with the frame splits referring to solutions used in the late nineteenth and early twentieth century (multiple columns and beams) are in scarce. Only a few manufacturers make the effort to elaborate individual solutions tailored to a specific historical object. And only one company has assembly lines designed purposefully for historic buildings. While, in most cases, the standard technologies are used for aluminium windows and their adjustment is limited to only, more or less successful, decorating the windows with profiles stuck on glass.

4. CONCLUSIONS

Typological features of Lodz factories (including a modest articulation of walls and a large share of windows in the façade surface) make the window frames play an important role for the image of the industrial heritage and identity of the town. Adapting buildings to new functions implies the necessity to adapt them to modern needs, which usually leads to the replacement of windows. Even when the divisions and style of old windows are maintained, the original historic substance is irretrievably lost, depriving them of the authenticity and the reduction of the educational value of the object. Therefore, any effort should be made to increase the awareness of the value of historic windows, as well as the ways of their protection and preservation. At the same time, the increasing number of manufacturers is producing windows which are very similar to their original forms.

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PROBLEMATYKA KONSERWATORSKA ŚLUSARKI OKIENNEJ W XIX WIECZNYCH OBIEKTACH PRZEMYSŁOWYCH NA PRZYKŁADZIE ŁODZI

S t r e s z c z e n i e

Wstępem do omówienia problematyki historycznej ślusarki okiennej w architekturze przemysłowej jest osadzenie w kontekście historycznym. Zagadnienie zostanie omówione na przykładzie łódzkich okien w XIX-wiecznych budynkach przemysłowych, jak również w kontekście rozwiązań występujących w innych krajach europejskich. Charakterystyka standardowego okna fabrycznego przestawiona jest w oparciu o analizę typologiczną. Ocena walorów metalowych okien historycznych jest punktem wyjścia dla zagadnienia czy i dlaczego należy chronić oryginalną ślusarkę okienną. W pierwszej kolejności podnieść należy kwestię wpływu ślusarki okiennej na identyfikację zabytku jako obiektu poprzemysłowego, jak również znaczenie dla tożsamości lokalnej. Zaletom

estetycznym i technicznym przeciwstawiają się usterki i degradacja okien. W artykule zostaną omówione główne problemy konserwatorskie dotyczące metalowych okien historycznych oraz możliwości postępowania z nimi w świetle adaptacji budynków postindustrialnych oraz konieczności spełniania współczesnych norm budowlanych. Sposoby ochrony i naprawy metalowych elementów architektonicznych bądź możliwości wymiany okien na nowe zostaną omówione w oparciu o przegląd łódzkich rozwiązań w budynkach adaptowanych na nowe funkcje oraz przedstawienie dostępnych obecnie na rynku ofert okien historyzujących.

CIVIL AND ENVIRONMENTAL ENGINEERING REPORTS

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SOBIESKI PALACE IN LUBLIN AFTER THE ASSESSMENT OF THE EXISTING CONDITION. RESTORATION AND MODERNIZATION PROJECT

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The Palace, situated in Bernardyńska Street in Lublin, has a checkered history – it was, among others, mentioned in the vetting in 1661; then it was the Sobieski family's property for about 100 years. In the subsequent periods, its owners changed several times, and the object itself was repeatedly rebuilt. Since 1959, it has been used by the Technical University of Lublin. Because of the alarming state of the palace buildings – after carrying out the necessary research and expertise - a multi-disciplinary restoration and modernisation project has been elaborated, together with the proposition for the EU financed grant from the Operational Program "Development of Eastern Poland". The paper presents the analysis of the existing state of the palace, and also the modernisation project. The new EU programme "Town Restoration Programme 2014-2020" opens the opportunity to implement this project after the functional correction.

Keywords: Sobieski Palace in Lublin, the Technical University of Lublin, place identity, modernisation of a historic building

1. NTRODUCTION

The complex of the Sobieski Palace is situated in Bernardyńska Street in Lublin, in Żmgród district, in the town centre. It consists of eleven objects: a palace building, two outbuildings, two guardhouses, six household buildings and two

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courtyards. It is situated in the proximity of the brewery building (Bernardyńska 15) and the modernised object located at Bernardyńska 11.

The palace itself has a checkered history – its beginnings are unknown, it was mentioned in J. Braun's works „Civitates orbis corrarum", 1617. The vetting, in 1661, contains the record that the palace belonged to the Sobieski family, and it continues to be their property for another one hundred years. In the subsequent periods, its owners changed many times (the Radziwiłł family, the Brzeżiński family, the Stachociński family and others)., and the object itself fulfilled various functions – it housed among others a mill and a gymnasium for girls. The Palace was rebuilt repeated number of times. Its present appearance is due to the expansion of the project in 1884 by Marian Jarzynski, when it was converted for residential purposes, raised by two floors, the interior decorated with stucco, and the whole was given an eclectic look.

In 1945, the Palace was taken over by the Treasury. Since 1959, it has been used by the Higher Engineering School, later transformed into the Technical University of Lublin [3]. Currently, the courses for students of Architecture and Urban Planning are held there.

Nowadays, the objects of the Palace complex are in an alarmingly poor technical condition. Due to this fact, the decision of its urgent modernisation has been made. After performing the research and expertise – necessary since the object is inscribed into the register of historic monuments – a multi-disciplinary project of its restoration and modernisation has been prepared, together with the proposition for a financial grant from the Operational Programme "Development of Eastern Poland".

2. THE ANALYSIS OF THE CURRENT CONDITION

2.1. General Condition

The palace consists of three parts: an eight-storey tower, tapered upwardly (elliptic shape – 1188 x 1168 cm at the base, 967 x 946 cm at the finial), a four-storey right wing (with the attic and a basement crossing), and a four-storey left wing.

After the restoration works, in 1884, the palace gained its eclectic appearance which preserved till today. The recent elevation works were performed in 1986, since than no repairs have been carried out, hence the condition of the elevation is critical – numerous cracks are visible as well as plaster losses (or its complete lack, as in the case of north elevation), moisture, stains from leaking flashings. The elevation also poses a threat to users due to the fragments of the plaster which break away. Thus, it was necessary to build a

provisional canopy over the entrance protecting against a possible threat. Also, window frames (box windows) and the doors are in bad shape - clear distortions and leakage are visible.

Fig. 1. A general view of the Palace – the current condition (2008). Photo by J. Wrana.
Fig. 2. Close-up of the tower (2008). Photo by J. Wrana.

Inside, there are conspicuous cracks and delamination of walls, salt efflorescence, poor flooring and joinery. Also, building equipment does not meet the requirements of a modern educational facility - there are no special rooms, adequate facilities, and facilities for people with disabilities.

The structural condition also leaves much to be desired, due to the cracks, subsidence, humidity and biological pests.

The two outbuildings, only one of which is currently used, are also in critical condition and require a thorough, comprehensive renovation.

2.2. Structural issues

The tower has six floors above the ground and two underground floors, whereas the wings - three floors above the ground and a basement.

The foundations are made of full ceramic bricks on lime mortar (tower) and limestone (wings). They are in an unsatisfactory condition due to moisture, corrosion of the ceramic and limestone materials, the lack of isolation and shallow foundation (in extreme cases, above the frozen soil zone). They require a complex analysis, and then concrete foundation needs to be performed of the widths adjusted to the designed loads after the reconstruction.

The walls in the cellar - to the height of about 180 cm - are made of ceramic bricks on lime mortar, and above that height - of limestone on lime mortar. The basement walls are made of – limestone with brick insertions. The construction walls on the remaining floors are made of limestone (rocks) and

ceramic bricks. Partition walls - built of ceramic bricks or timber. The walls above the ground preserved fairly well. At present they pose no threat to the safety of the building, but they need to be restored and reinforced.

There are numerous reasons for the cracks and subsidence of the walls and foundation. The historic background may be considered as one of them (a heterogeneous structure, the lack of expansion joints). Also, various foundation levels of walls, shallow foundation, as well as uneven loading of the subsoil contributed to the mentioned damages.

Arch vaults made of ceramic bricks survived in the basement, there are also the Klein ceilings and wooden ones. The arch vault is in a good shape, and after restoration it can be maintained. The Klein ceilings over the basements need to be cleaned out of corrosion, covered with a mesh and re-plastered. The beams need to be strengthened in parts where they are over 5.0 m long. Wooden ceilings over the ground floor the first floor do not demonstrate any corrosion. The ceilings are possible to be renovated and adapted, but some of the beams need to be strengthened, the wood needs to be impregnated with non-combustible materials, the floors need to be protected both from the bottom and the top with a material of 60-minute fire-resistance. Ceilings over the second floor and the higher ones must be replaced due to corrosion damages, abnormal deflection as well as fungi and insects damages.

The building is covered with a gable roof, with a rafter-purlin strap with columns and struts, and a conical roof of the tower. The roof truss is severely damaged by pests and should be totally replaced. Roofing - galvanized straight seam - is heavily corroded (on tower - 95%, on the wings - 50%), also should be replaced.

In the tower, there are two staircases: an eight-floor staircase (double-flight masonry stairs in the cellar; single-flight wooden - in the basement; masonry winder stairs with wooden steps in the remaining parts) and a three-floor staircase (double-flight, wooden flights and steps). Both staircases do not meet the technical requirements for utility objects, among others fire-resistance requirements, the landing sizes, the height of the rail. Thus, posing threat to the users, they need to be rebuilt.

A significant problem is the building moisture and humidity. According to the investigation carried out by Aquapol in 2007 [4], the degree of the humidity of the whole complex should be classified as: very humid, wet and very wet. The moisture limit of the external walls ranges from 180 to 240 cm above the ground level, which describes the condition of all the walls in the cellars, basements, and the first floor (to the moisture limits) as very humid, wet or very wet. The external walls are not insulated thus the walls absorb capillary moisture to the hight of 2.4 meters above the adjacent ground.

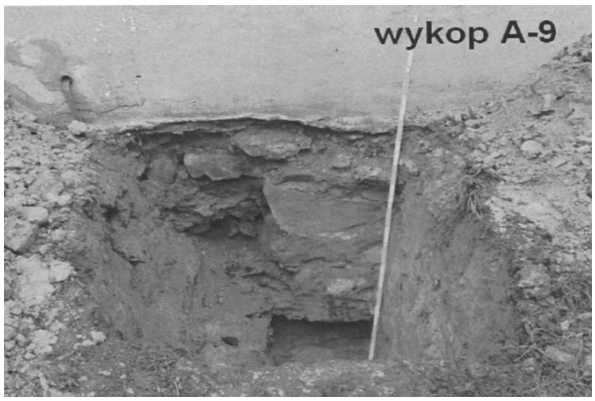

Fig. 3. Lintel with a visible crack exposing the reinforcing steel, 5th floor (tower) [4].
Fig. 4. Dig A-9 from the courtyard. Visible stone wall corroded surface, with losses of stone and corroded mortar, no insulation [4].

2.3. Biological issues

Unfortunately, the issues connected with the poor condition of the structure and elevation is not the only ones. Also, the occurrence of fungus *Serpula lacrymans* was observed. The fungus belongs to the first group – most harmful for the wooden parts of the building, which are losing weight and strength (crumble in your fingers). It also destroys the walls and plasters and creates an unfavourable microclimate (due to odours). It was found in the samples obtained from the ceiling over the 2nd in the attic, and on the 4th floor in the ceiling of the tower.

The next problem is the insects: the common furniture beetle *(Anobium punctatum)* and the house longhorn beetle *(Hylotrupes bajulus).* The common furniture beetle was found in the samples obtained from the elements of the roof truss (among others: rafters, pillars, attic walls). It mechanically destroys wood by drilling a number of sidewalks during the larval period (3-4 years). The house longhorn beetle was found in the roof truss over the second floor in the joists in the attics. The most serious damages occur in older elements of the roof truss. They are impossible to be restored – they must be replaced.

2.4. The summary of the analysis

The Palace building is in an alarmingly poor technical condition. It poses a threat to its users – students and workers. Long-term negligence in the maintenance and the lack of repairs (or their insufficient accuracy) made the condition of the palace leaves much to be desired both in terms of structure (cracking, corrosion) and appearance (destroyed elevation). In order to continue

to use it, thorough and comprehensive renovation works must be carried out, which would include: the structure and elevation, interior finishing, as well as adjusting the object to the current standards prevailing among universities (like specialised workshops, drawing and design rooms, etc.), and also adapting it for people with disabilities (suitable toilets, passenger lifts, wider doors, etc.).

In view of these findings, it was decided to elaborate a project of the palace restoration and modernization together with a proposal submitted to EU funds for a grant from the Operational Programme "Development of Eastern Poland". The project involved a comprehensive modernization of the building and its adaptation to the current needs, while meeting all the conservation requirements of and the respect for its historic value.

3. RESTORATION AND MODERNISATION OF THE OBJECT

Multiple modification of the complex resulted in the preservation of only minor historical fragments (i.e. parts of stone walls of the basements and the elevation design) – hence the project pays particular attention to their protection and exhibition, while having a relatively great amount of freedom in adapting the rest of the building.

The proposed solution was an interference with author's introduction of a new program in an existing complex of historic buildings, preventing further destruction and degradation.

The project assumed a conversion of the existing main building and two collateral outbuildings, while merging the space through the addition of new objects (connectors). The formal assumption to the object shaping was to preserve all important elements, due to their conservation values, in the existent building, and simultaneously supplementing the building with new elements. To exhibit the architectural form and the rich ornamentation of historic buildings, all new buildings have a very simple and modest architecture with modern details; therefore, a passage between the existing outbuildings and the main building was designed in a form of a plane of glass façade, divisions of which refer to the levels of the existing cornices. Additionally, the application of these passages between the existing objects clearly depicts the axis of symmetry, emphasizing the dialogue between the past and the present.

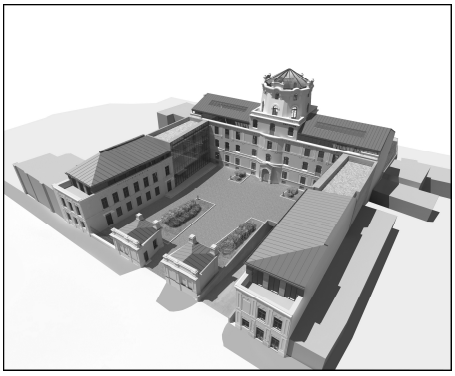


Fig. 5, 6. Visualizations of the modernization project of the Sobieski Palace: general view, courtyard. Computer imaging – prof. A. Getter's team (after the project implementation).

The mentioned above passages are just the most interesting new elements together with the car parks and the auditorium which is submerged on an earthwork ground (on the escarpment opposite to the entrance courtyard), in order not to destroy the proportions of the elevation of the main building. A sloping, concrete wall which hides the new facade refers to the existing escarpment and constitutes a kind of base for the historic building of the palace. Covering the walls with evergreen vines will make it fuse with the current green slope, making the auditorium – of significant overall dimensions – "disappear" visually.

The form of architecture of the designed interiors involves exhibiting the existing structure of the walls and ceilings at levels below the ground floor.

The project envisages the improvement of the environment of Lublin downtown by replacing the existing coal boiler with a modern automatic gas heating or join the complex to the urban heating network. New modern communication solutions (glass passages, passenger lifts, wide corridors to ensure accessibility for people with disabilities) will be introduced. The "green roof" solutions, designed over the garage and auditorium, will increase the biologically active space.

The modernized palace will include comfortable rooms, dean's offices, staff rooms and a drawing room, and a staircase in the tower (suitable for students' work exhibitions). The main building is connected to the auditory and the car park, located on levels -1 and -2. The outbuildings are planned to house: a multimedia library, digital media laboratory, laboratories, archives and rooms for scientific and research work. Apart from staircases, also toilets have been located in the passages (including toilets for people with disabilities); placing

them in the newly built passages will make it possible to design them better, thus improving users' comfort.

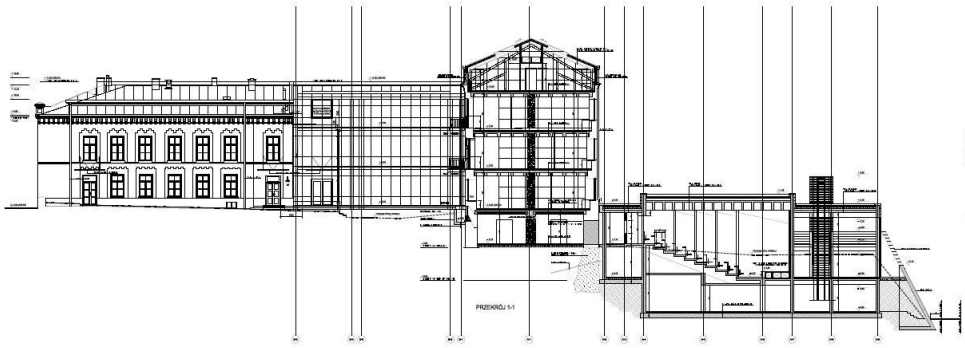

Fig. 7. The cross section of the corpus of the Palace with the designed double-floor auditorium, the view of the passage and outbuilding. The concept - a group of employees led by arch. Jan Wrana.

Thanks to the modernization project, the palace can become a comfortable place for both learning and work, and also has the potential to become an important place in the city centre of Lublin.

4. NEW-OLD STRUCTURE

The modernization project includes all the remarks contained in the construction expertise. Foundations have been strengthened and insulated, ceilings have been either replaced or strengthened, and window and door woodwork has been replaced completely. All the additions to or replacement of the structure elements are designed as made of raw concrete.

All new floors designed for above-ground floors of the main building will have a reinforced concrete panelled structure, made of raw concrete. Thus, all the existing building threads will be possible to exhibit in relation to the new fragments, emphasising the vivid contrast old-new.

Also the roofing and the truss are planned to be replaced totally. The tower, as the most distinctive element of the solid, was decided to be covered with a glass ceiling, which will light the main staircase perfectly. Large sheets of tempered glass are used for glazing the door openings and partitions, in order to make the impression of space.

The project distinctly differentiates between the new and the old tissues, paying particular attention to the respect of historic elements.

5. CONCLUSIONS

The building is currently in poor condition, but still half of it is in use. It is necessary to protect the palace, since the building was inscribed on the register of monuments years ago - as an important part of the centre of Lublin.

The complete construction project of the reconstruction and modernization of the palace has been submitted to the authorities of the University and is waiting to be implemented. However, the further preparatory action has been stopped because of legal problems (ownership issues). In passage with the construction of a new building for the faculty of Architecture and Urban Planning, the proposed primary function needs to be changed. Financing the modernization of the Palace from the EU's new program "Urban revitalization 2014-2020" seems to be the chance for the project to be implemented. Additionally, this could be supplemented with transforming the palace into an integrative centre of science and a dialogue of the multicultural Borderland. This would undoubtedly be an interesting point on the cultural map of Lublin and a chance for the Palace to receive a "second life".

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PAŁAC SOBIESKICH W LUBLINIE PO OCENIE STANU ISTNIEJĄCEGO. PROJEKT REWALORYZACJI I MODERNIZACJI OBIEKTU

S t r e s z c z e n i e

Położny przy ul. Bernardyńskiej w Lublinie pałac ma burzliwą historię - wzmiankowany został m.in. w lustracji z 1661 roku; po jego rozbudowie pozostawał własnością Sobieskich przez ok. 100 lat. W kolejnych okresach często zamieniali się jego właściciele, a sam obiekt był wielokrotnie przebudowywany, mieścił się w nim między innymi młyn oraz gimnazjum żeńskie. Od roku 1959 użytkowany jest przez obecną Politechnikę Lubelską. Z powodu alarmującego stanu technicznego obiektów zespołu pałacowego - po dokonaniu koniecznych badań i ekspertyz - przygotowany został wielobranżowy projekt rewaloryzacji i modernizacji z wnioskiem o dofinansowanie z Programu Operacyjnego „Rozwój Polski Wschodniej". W niniejszym artykule przedstawiono analizę stanu istniejącego pałacu, a także opisano projekt jego modernizacji. Szczególną uwagę poświęcono połączeniu zabytkowej tkanki z nowymi elementami, takimi jak przeszklone łączniki czy aula, gdyż nadrzędnym celem projektantów było uszanowanie i wyeksponowanie istniejącej, zabytkowej formy (projekt uzyskał pozytywną opinię Wojewódzkiego Konserwatora Zabytków w Lublinie). Nowy program unijny „Rewitalizacja miast 2014-2020" stwarza szansę realizacji tego projektu, po korekcie funkcji.

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