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Assessment of Technical Conditions in Adapting a Historic Warehouse's Space Functionality

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Abstract

The paper is a case study in the assessment of the technical condition of a building that is an immovable monument located in a former shipyard area. Due to the change in the use of the industrial area and the intention to build a production hall, it was necessary to consider the demolition of the historic building, while preserving as many of its historical aspects as possible. The paper presents a detailed description of the methodology for assessing the technical condition of a warehouse building and describes the proposed variants of its further use.

Key words: monuments, renovation and repair works, modernization, construction works

1. Introduction

The technical condition of buildings, including those that are immovable monuments, is influenced by both design errors and shortcomings, as well as execution errors and omissions. The way these facilities are used is also important.

Correctly planned [A1÷A4] and carried out in accordance with the principles of technical knowledge and in accordance with professional practice, renovation, repair and modernization works planned to be performed in a historic building [B1÷B2] should not result in exceeding the budget intended for their implementation [C1÷C5], unless a significant error was made at the stage of preliminary design, i.e. preparation of technical and economic assumptions, consisting in underestimating the value of construction works planned for implementation.

Proper assessment of the technical condition of buildings, in particular immovable monuments, is one of the most difficult activities in engineering [D1÷D23]. The conclusions from the diagnostic activities carried out not only determine the scope of renovation works, which involves incurring very high financial costs, but also very often determine the assessment of the possibility of further operation of the facility in question due to its technical condition [E1÷E31]. An engineering-correct assessment of the technical condition makes it possible to clearly determine whether further use of the facility is possible due to the safety of the structure and operational safety.

When assessing the technical condition of each building, and in particular an immovable monument, not only its structural system should be properly recognized, but also the impact of external conditions, e.g. dynamic traffic impacts [F1÷F12]. An important issue is to take into account the deformation of the subsoil, in particular in terms of its locally reduced load-bearing capacity [G1÷G20]. In the case of historic buildings, it is very important to properly assess the technical condition of wooden elements, both structural and finishing elements [H1÷H22]. The issues of thermal protection [I1÷I40] and taking into account the often overlooked impact of natural conditions [J1÷J4] are also very important. A proper assessment of the technical condition of buildings requires recognition of their structural system and knowledge of the

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technical and technological solutions used during their implementation, which is particularly important in the case of historic buildings [K1÷K55], understood as objects constructed in recent years. This issue is particularly important when the analysis to assess the technical condition concerns historic military facilities [L1÷L3].

The basis for assessing the technical condition of buildings is the currently applicable regulations, but recommendations and provisions of standards that have already been withdrawn (outdated), but are still widely used in the engineering environment, are often used [M1÷M26]. This approach is very often used when assessing the technical condition of historic buildings.

When carrying out renovation and repair works, remember to follow occupational health and safety rules - this is important because renovation works are most often carried out in facilities that are often not taken out of service, but are only limited [N1÷N9].

When assessing the technical condition of buildings, the provisions relating to the legal aspects of construction [O1÷O6] and the impact of the above regulations on the scope of proposed renovation, repair and modernization works apply. In the case of immovable monuments, there are also detailed conservation requirements, which often have a decisive impact on the form and scope of construction works planned to be carried out, including renovation works [P1].

The aim of the paper is to present the results of the analysis of the technical condition of a historic Warehouse building located in the former shipyard area in connection with the planned construction in the place of the existing location of the production hall warehouse building.

The purpose of the assessment of the technical condition of the historic building was also to determine whether, due to its current technical condition, the safety of the structure and the safety of use of the facility as a whole are ensured. The scope of the analysis included the indication of the target scope of work necessary to be carried out in the area of the building in question in order to bring it to the proper technical condition. The scope of the analysis also included answering the question whether the planned construction works would be possible to carry out due to the following conditions:

- technical - taking into account the possibility of carrying out planned renovation and modernization works (main (basic) condition),
- economic - taking into account the profitability of implementing the investment project (auxiliary condition).

2. Characteristic of the Warehouse Building

The building was built in the early 20th century and was initially used as an oil warehouse for the shipyard's production needs. The building was constructed as a single-story building with a complete basement, in horizontal projection based on a rectangle with dimensions of ~10,50 m × ~24,50 m.

The walls on the basement level were made of full ceramic brick with a thickness of 51 cm, on the ground floor the walls were also made of full ceramic brick with a thickness of 25 and 38 cm with local thickening to the interior of the building to a thickness of 51 cm. The thickenings were spaced every ~400 cm, which was a consequence of the structural system used, which consisted of transverse reinforced concrete frames placed in the basement level every ~400 cm (axial spacing). Four transverse frames were constructed in the building.

At the basement level, the transverse frames were constructed as three-span, with a central bay ~200 cm wide, supported on columns with a cross-section of 25-25 cm. The end beams had a span of ~337 cm. The height of the transoms of the transverse frames was 35 cm. In the transverse frames next to the columns, 10 cm high bevels were constructed along a length of 35 cm. Ribs with a height of 25 cm and a width equal to the height corresponding to the dimensions of the column (internal ribs) were constructed perpendicular to the transverse frames. In the place where the ribs meet the transverse frames, 10 cm high chamfers were constructed along a length of 35 cm. The dimensions used meant that in the place where the ribs meet the transverse frames, the height of the ribs increased by the chamfers was equal to the basic height of the transom, i.e. 35 cm. The extreme spans with a span of ~337 cm did not have any support in the form of columns, but at a distance of ~200 cm from the internal column, ribs (external ribs) with dimensions identical to those constructed in the middle span (internal ribs) were supported on the extreme spans of the transverse frames. The extreme ribs also had chamfers, which meant that at the point of contact with the transoms of the transverse frames, the height of the chamfered section was equal to the height of the transom, i.e. 35 cm.

The ceiling above the basement, constructed as a reinforced concrete slab supported by ribs (internal and external), was ~25 cm thick. A 10 cm long board bevel was constructed along the ribs.

On the ground floor, the transverse partition walls were arranged at a spacing corresponding to the spacing of the transverse frames in the basement level.

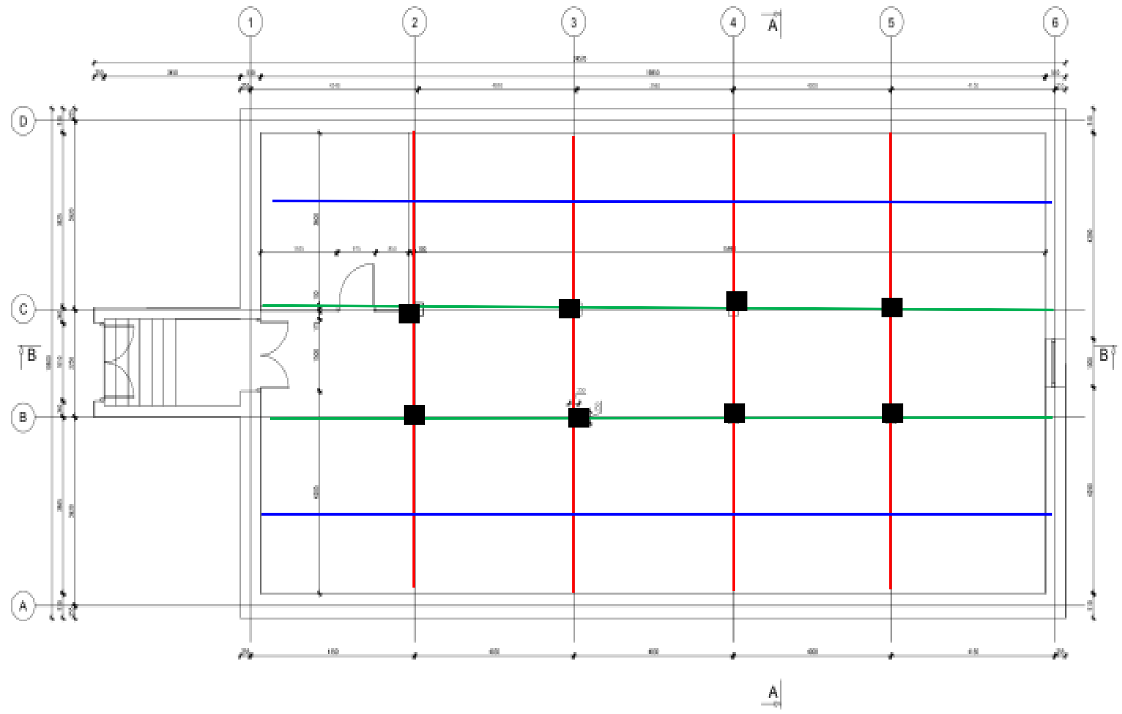
The building's covering was a reinforced concrete, monolithic slab arch, with local widening (flattening) where it rested on the longitudinal walls. At a spacing corresponding to the spacing of the transverse frames in the basement, the slab arch had bracing in the form of a tie made as a reinforced concrete beam with cross-sectional dimensions of 12×12 cm. In the central part, the ties were suspended from posts with cross-sectional dimensions of 12×12 cm, spaced at ~200 cm, which corresponded to the width of the central track at the level of the basement floor. Wooden beams measuring 12-16 cm, spaced every ~60 cm, were supported on reinforced concrete ties. On part of the building's projection, a soffit made of 2.2 cm thick boards was nailed to the boards, on which there is a layer of hard mineral wool with a 6 cm thick aluminum screen. In the remaining part of the building, the space under the arch was made of reinforced glass, partly of plasterboards, and in some rooms the space under the arch was open and covered with a wooden ceiling. The characteristics of the structural system of the building that is the subject of this study are shown in Fig. 1.

Over the period of its operation, the building was used as rooms for various purposes, mainly as storage rooms: initially it was used as an Oil Warehouse. In later years, it was also used as a staff canteen. The building has not been used for several years and has been completely decommissioned. The building's utilities (water, electricity) were disconnected, and the facility itself was secured against access by third parties.

Over the years of operation, the building has undergone numerous reconstructions and works including changing the functional layout. The building did not undergo any major renovation, only ad hoc renovations were carried out as part of security works and periodic renovations (planned).

In the rest of the paper, the building will be referred to interchangeably as the Oil Warehouse building or as the Warehouse building.

a)



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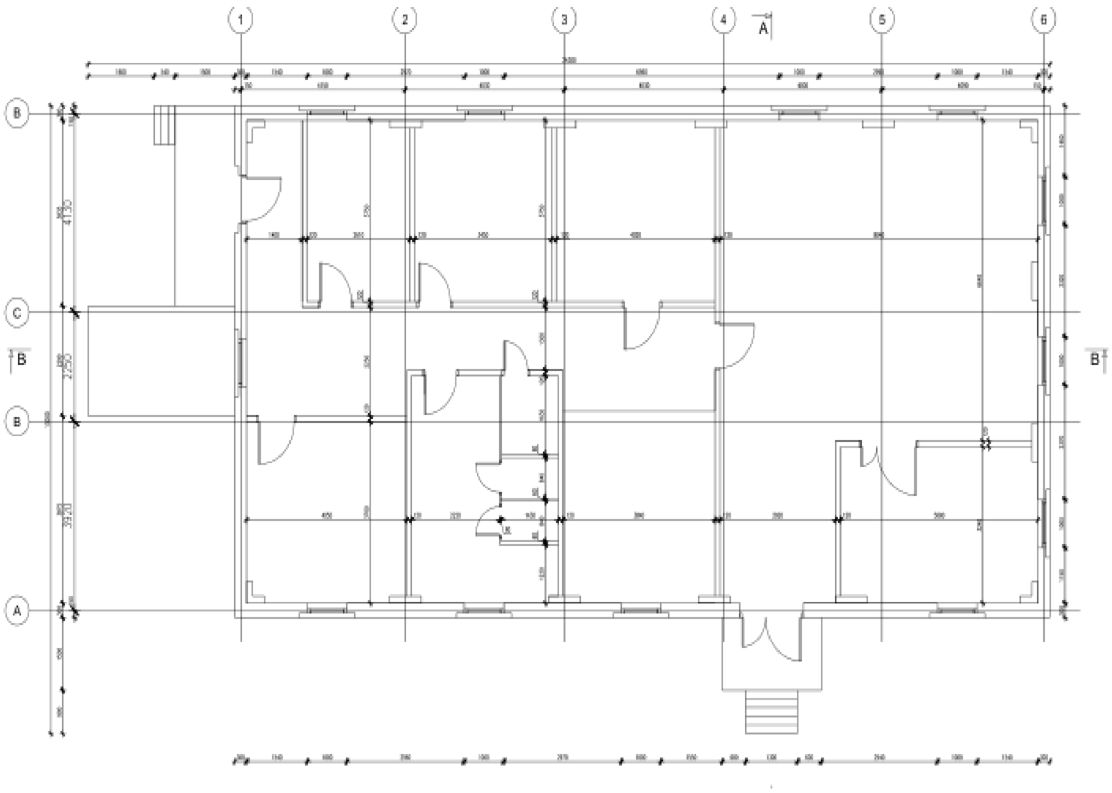
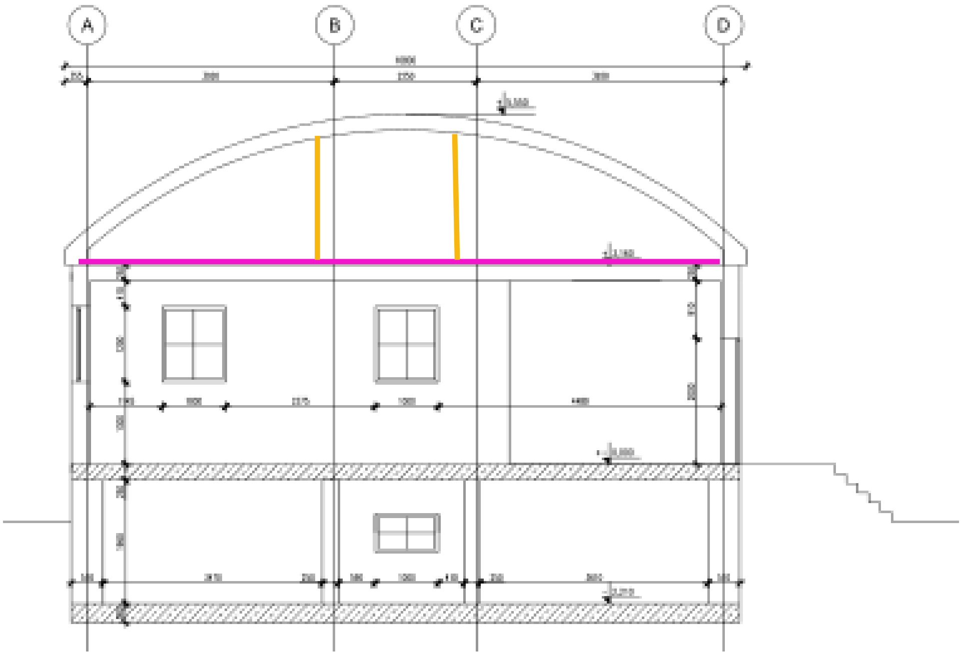


c)



d)

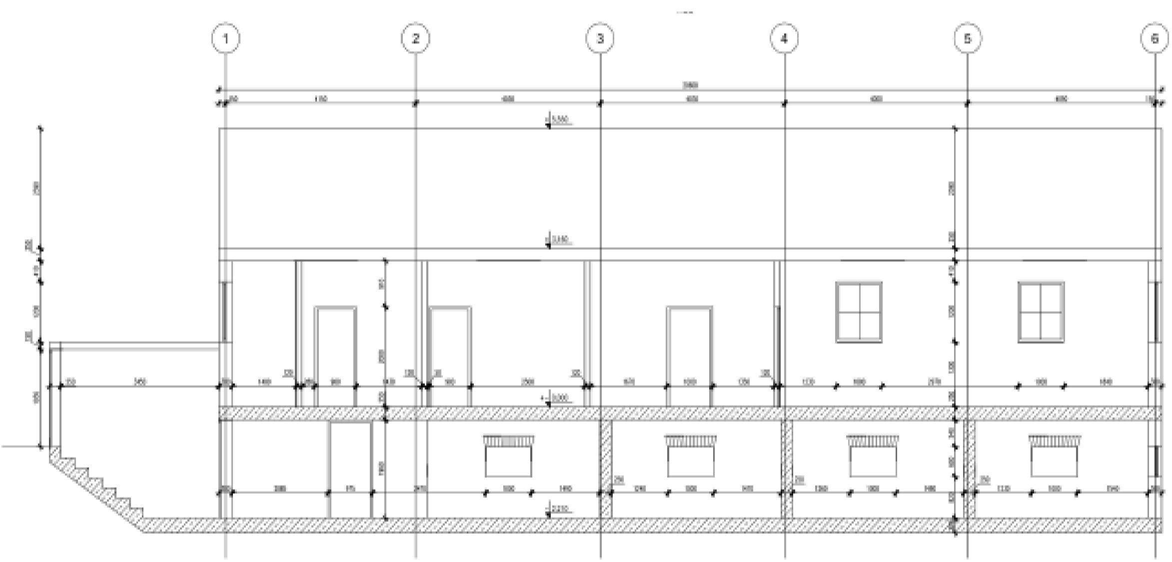


Fig. 1. Warehouse building: projections: a) basement floors, b) ground floor, cross-sections: c) transverse, d) longitudinal (*based on inventory*) continued

a)

b)

c)

d)

Photo 2. Warehouse building - elevations: a), b) south-eastern, c), d) south-west

a)

b)

c)

d)

e)

f)

Photo 3. Warehouse Building - elevations: a), b) south-eastern, c), d) south-west Warehouse Building - basement: a) view from the bottom of the ceiling above the annex, b) dampness of the external walls, damage to the concrete cover of the reinforcing bars: c) , d) beams, e), f) ceiling slab

a)

b)

Photo 4. Warehouse building - covering the communication corridor on the ground floor:
a) wooden ceiling lining, b) reinforced glass in steel frames

a)

b)

c)

Photo 5. Warehouse building - reinforced concrete tie in the view from the rooms on the ground floor:
a) general view, close-up: b) horizontal element - horizontal tie, c) vertical element - post

Photo 6. Warehouse building - attic space: a) stiffening ribs below the curvilinear covering slab, connection: b) post - curvilinear covering slab, c) post - horizontal tie, d), e) damage to the concrete cover of the reinforcing bars of the curvilinear covering slab

a)

b)

Photo 7. Warehouse building - attic space: a) arrangement of wooden ceiling beams of the covering structure above the ground floor, b) supporting wooden ceiling beams on a horizontal tie

3. Description of the Conditions of the Existing Warehouse Buillding

Adjacent to the gable wall of the building on the south-eastern façade was an extension made of solid ceramic bricks, 25 cm thick, in which there were gates (entrance doors) to the rooms in the basement level (Photo 2a, b). The walls of the extension, especially under the covering slab, had very extensive mechanical damage, numerous chips and cracks. The level of the top of the annex roof was at the level of the top of the window strip of window openings in the gable wall of the Warehouse building. In the gable wall, the entrance to the Warehouse building led through a steel ramp.

In the view from the south-west façade, the external wall is made of solid ceramic bricks, 25 cm and 38 cm thick, with local thickenings, every ~400 cm, to the interior of the building, resulting from the structure of the covering. The wall was not plastered, like the other facades of the building (Photo 2c, d). There were scratches visible on the wall surface, especially above the bricked-up window arches at the basement level (Photo 2c). Locally, mechanical damage was visible on the wall surface - chipping and missing bricks, weathered joints, some of the joints were empty.

The technical condition of the wall on the north-west façade was similar to that of the south-east and south-west façades. The wall had numerous mechanical damages - chipping and cracking of bricks.

The technical condition of the north-eastern facade was similar to that of all other facades of the building in terms of the extent of wall damage - mechanical damage to the brick wall, defects and weathering of the joints were visible.

In the view from below, the ceiling of the extension had very intensive damage. It was made as a concrete slab reinforced with metal strips cut from metal barrels (Photo 3a). The strips were partially straightened and arranged as reinforcement elements of the concrete slab. A beam element (steel ceiling beam) was visible in the middle of the extension's length. Both the elements made of metal strips and the steel beam showed corrosion, and traces of moisture were visible on the underside of the covering board.

Intense dampness was visible on the external walls on the basement level (Photo 3b). Moisture intensified in the floor area, especially in the southern part of the building. The floor in the basement was collapsed and cracked, and on a large area of the basement floor the floor was very damp. The monolithic reinforced concrete structure of the ceiling above the basement shows no signs of overload - there were no visible signs of scratching in the middle of the span of both the beams, the internal ribs and the external ribs. There were also no traces of scratches in the area of structural joints, i.e. at the junction of columns, transoms and internal ribs. No signs of overload were identified at the junction of the external ribs with the transoms.

Reinforced concrete elements, in particular beams and internal and external ribs in the zone of external walls, showed very intensive falls of the concrete cover. Reinforcing bars, both the main (structural) reinforcement and the stirrups, showed extensive corrosion, including pitting corrosion (Photo 3c, d). Intensive corrosion damage was also visible on the bottom of the ceiling slabs filling the system of beams and ribs (Photo 3e, f). The rooms on the basement level were not used.

The rooms on the ground floor were also unused, as was the case with the basement floors. In most cases, the rooms were empty and there were no visible signs of moisture on the external walls. Wire and pipe installations were mostly dismantled, and the hygiene and sanitary rooms were inoperable. In the southern part of the building, the ceiling consisted of a wooden soffit mounted to the structural elements of the covering (Photo 4a), in the central part, at the ceiling level, there was a reinforced glass covering (Photo 4b), while in the northern part the finishing was made of plasterboards.

In the room used when the building was used as an Employee Canteen, there was no horizontal ceiling lining, but only a curved structure made of boards (Photo 5a). In this room, a steel structure was visible under the building's roof, probably the remains of a winch for transporting materials, including oil barrels - the location of the winch structure is in the immediate vicinity of the door opening in the north-eastern façade. In this room, the structure of a reinforced concrete tie is also visible - a beam with cross-sectional dimensions of 12×12 cm (Photo 5b) and posts supporting it with identical dimensions (Photo 5c). There were no visible signs of scratching of the post-tie joints.

During the inspection, only part of the attic was possible (Photo 6a). The view from the bottom of the slab arch showed traces of moisture, the concrete cover was falling off locally, and corrosion of the reinforcing bars was visible (Photo 6a, d, e). The spacing of the reinforcing bars was on average 30 cm. There were no visible signs of damage where the posts were connected to the slab arch (Photo 6b), similarly to the case where the posts were connected to the tie (Photo 6c).

In the field bounded by axes 2-3, 40 cm wide ribs were visible, lowered by 10 cm below the bottom of the plate arch (Photo 7). The ribs started ~170 cm from the level of the slab arch support, and the axial distance between them was 100 cm. Wooden beams measuring 12-16 cm, spaced every ~60 cm, were supported on reinforced concrete ties (Photo 7). In the part of the attic that could be inspected, a soffit made of 2 cm thick boards was nailed to the bottom of the ceiling above the ground floor, on which there was a layer of hard mineral wool with a 6 cm thick aluminum screen (Photo 7b).

4. Analysis of the Condition of the Existing Warehouse Building

During the inspection of the building, no visible defects or damages were found in its area, the morphology of which would indicate that their cause may be the negative impact of the traffic of motor vehicles (cars) on the internal roads of the shipyard.

No damage typical of vibrations caused by the movement of motor vehicles was found in the facility (scratches and cracks with a typical X or ½ X morphology). During the on-site visits, no noticeable vibrations of the ground around the building were detected - no measurement of ground vibrations around the facility was carried out, and no vibration measurements of the structure of the facility itself were carried out: taking into account the location conditions and the current technical condition, dynamic measurements were considered completely unnecessary.

Moreover, it was established that in the past period no trees with significant trunk or crown size were removed from the area adjacent to the facility. In the past period, no new tall trees and shrubs were planted. Therefore, there were no grounds to conclude that the root system of the tree stand had ever or will have in the future a significant impact on the occurrence of defects and/or damage to the foundations of the Warehouse building, as well as to formulate the thesis that the roots of the tree stand have contributed or will contribute in the future to disturbances in soil and water conditions in the subject area, in accordance with the mechanism described in [J1]÷[J4].

Table 1. Moisture criterion of a brick wall depending on the mass humidity value U_m

dry material	**damp material**	**wet material**
moisture U_m [%]		
$U_m < 4$	$4 \leq U_m \leq 12$	$U_m > 12{,}0$

4.1. Analysis of the Technical Condition of the Warehouse Building

Foundations

The building covered by the study was constructed with a complete basement. There were no visible traces on the external walls whose morphology would indicate that they were caused by uneven settlement of the foundations. At the stage of assessing the technical condition, the excavation of foundations was abandoned - with a high probability, taking into account the technical solutions used in buildings from the period in which the Warehouse building was constructed, its foundations were made as brick foundations. Regardless of the height of the foundation strips, the foundation level was at least 250 cm below the current ground level. In accordance with the requirements of the no longer applicable, but still widely used in engineering practice, standard PN-B-03020 *Direct foundation of structures. Requirements and calculations*, the depth of the frost zone in the building's location is 100 cm below the ground level - so the current foundation level of the building met the engineering technical requirements.

At the time of assessing the technical condition of the facility, the intended use of the Warehouse building was unknown, and as a result, the scope of work planned to be performed to bring it to the appropriate technical condition was also unknown. Therefore, it was difficult to determine whether it would be necessary to strengthen the foundations due to the load-bearing capacity. If the building was to be used as a warehouse, it is very likely that, taking into account current calculation procedures, it will be necessary to strengthen the building's structural elements, in particular the ceiling structure above the basement, which in turn will require strengthening the foundations.

To sum up, the foundations of the Warehouse building required renovation and repair work.

A completely technically and economically justified solution, and at the same time recommended from a technical and economic point of view, was the demolition of the existing foundations and the possible subsequent use of fragments of the original elements, in accordance with detailed conservation recommendations.

Vertical partitions (ceramic walls)

The vertical partitions of the building in the area of the main body were made of solid ceramic bricks as homogeneous walls.

Based on the macroscopic assessment, the bricks built into the walls on all floors (basement and ground floor) were rated as grades from 100 to 150 (*fb*=from 10 to 15 MPa), and the mortar as grades from M1 to M2 (*fm*=from 1 to 2 MPa).

There were no external signs indicating that the load-bearing capacity of the masonry structures had been exhausted - there were no visible signs of overloading of the external walls at the basement level as well as at the ground floor level. The scratches in the ceramic wall occurring in the corners of the building on the ground floor were of thermal origin and were the result of thermal deformations of the uninsulated brick wall. Very intense dampness of the external walls was visible at the basement level.

The extent of dampness in the basement walls indicated the complete lack or lack of technically efficient insulation of the vertical parts of the walls embedded in the ground. The intensification of dampness in the lower part of the walls indicated the lack or lack of efficient horizontal insulation made on top of the foundation lavas and/or horizontally below the floor in the basement rooms. In the basement rooms, there were visible traces of the development of biological corrosion of the walls, discoloration of damp bricks and mortar. In the floor area, damp joints have crumbled.

For the purposes of assessing the technical condition, control measurements of moisture were made on the wall ceramic elements (ceramic bricks) built into the walls of the Warehouse building. Mass humidity (U_m) measurements were made using an electronic hygrometer whose operation is based on the electro-resistive (resistive) method, which involves measuring the resistance of a material depending on its humidity, i.e. the water content in the material. Depending on changes in resistance, the estimated moisture of the material can be determined: volume (U_v) or mass (U_m). The moisture meter scaling technique used (using a fixed correlation curve) enabled direct measurement of mass humidity (U_m).

It should be noted that the obtained results of mass moisture Um measurements concerned the surface layer of the tested element and were approximate. The moisture meter used also allowed for measuring humidity in the deeper layers of the element, but this would have required the prior execution of control measurement holes, which was abandoned after an initial series of measurements and assessment of the level of moisture in the elements at the level of the basement and ground floor.

The criteria for assessing the moisture content of a ceramic brick material in relation to mass humidity (U_m) are presented in Table 1.

During the inspection, no samples of materials were taken for mass moisture (*Um*) testing using the dryer-weighing method, due to earlier tests carried out with a calibrated measurement sensor with specific correlation curves determined during previous comparative tests. In the dryer-weighing method, the mass moisture (U_m) of the material is defined as the ratio of the mass of water contained in the tested sample of the material to the mass of this sample in a dry state (dried to constant mass at a temperature of 105°C, in accordance with the requirements of the PN-EN ISO 12570 *Thermal and moisture properties of construction materials and products. Determination of humidity by drying at elevated temperature*).

The dryer-weighing method is the most reliable method of measuring mass humidity, however, due to the need to collect samples for testing (from the structure elements of the object), it is classified as the so-called destructive methods. The dryer-weighing method is most often used as a reference method for calibration and checking other measurement methods. This is a laboratory method that requires stationary instrumentation and physical collection of samples of the tested materials, which was omitted during the tests conducted in the Warehouse building.

The abandonment of the use of the drying and weighing method to assess the degree of moisture in the wall had no impact on the conclusions regarding the technical condition of the building in question as a whole.

Measurements using an electronic hygrometer were made from the inside of the building. In the case of measurements in rooms on the ground floor, the measurement was made without considering the thickness of the internal plaster.

Based on the estimated results of measurements with a hygrometer, it was determined that the degree of moisture in the external walls at the basement level, defined as the measured mass humidity U_m [%], was from 13,0% to 15,6%, which qualified the walls, especially in the flooring part, for considered wet (Table 1). In the ceiling zone, the walls were less damp, the degree of dampness, determined as the measured mass humidity U_m [%], ranged from 9,4% to 11,4%, which qualified the walls to be considered damp (Table 1). On the ground floor, the degree of moisture, defined as the measured mass humidity U_m [%], was ~3,8%, which qualified the walls to be considered dry (Table 1), only locally in the floor area the measured humidity was 6,8%, which qualified the walls to be considered damp (Table 1). It should be noted, however, that for the purposes of analyzing the technical condition of the Warehouse building, only surface moisture measurements of the masonry elements were made. In fact, in the case of masonry elements, the inner layers of the wall are usually the most damp, especially in the case of walls with increased thickness (≥ 38 cm). However, from an engineering point of view, the method of measuring moisture in the masonry elements can be considered sufficient to assess the current technical condition of the masonry part of the vertical partitions of the Warehouse building.

At the time of assessing the technical condition of the facility, its intended use was unknown, and thus the scope of work planned to be performed to bring it to the appropriate technical condition was unknown. Therefore, it is currently difficult to determine whether it will be necessary to strengthen the walls due to their load-bearing capacity, and if so, to what extent.

To sum up, it was found that the walls of the Warehouse building required renovation and repair work.

A completely technically and economically justified solution, and at the same time recommended from a technical and economic point of view, was the demolition of the existing walls and the possible subsequent use of fragments of the original elements, in accordance with detailed conservation recommendations.

Inter-story ceiling (above the basement)

The structural elements of the ceiling above the basement do not show any signs of overload - there are no scratches in the structural nodes where the transoms and internal ribs intersect and the transoms and external ribs intersect. No scratches were found in the middle of the span of the transoms or ribs.

During the inspection, very intensive loss of the concrete cover from the beam elements of the ceiling above the basement was found. The cause of the fall of the concrete cover is the swelling corrosion of the reinforcing bars, both the main reinforcement and the stirrups. In the exposed reinforcing bars, corrosion losses of the main reinforcement bars were found, reaching 20÷30% of the cross-sectional area. The cause of corrosion of reinforcing bars is increased humidity in basement rooms. Intensification of moisture damage to the reinforced concrete elements of the ceiling above the basement takes place in the wall zone, where condensation occurs on the basement walls.

At the stage of implementation of this study, detailed calculations of the ceiling load-bearing capacity were not performed. Their implementation would require taking steel samples for testing in order to determine the yield point, necessary for the correct dimensioning of the ceiling structure. However, taking into account the information contained in the publication Stahl in Hochbau, *Julius Springer*, Berlin 1938, the computational yield strength for construction steel from the period of actual construction of the Warehouse building should be within the range f_{yd} ~120 ÷ 150 MPa.

Core drillings were not taken from the elements of the ceiling structure above the basement to check the compressive strength of concrete (characteristic compressive strength f_{ck}). Based on a visual assessment and simplified measurements made using a Schmidt type N hammer, the concrete in the ceiling structure above the basement was determined to be class C12/15 (B15) to C16/20 (B20). The homogeneity of the concrete was assessed as good, especially in slabs and beams, and as sufficient in the ribs.

It should be remembered that only the adoption of actual material parameters in the verification calculations allows for the estimation of the actual load-bearing capacity of the structural system, such as the ceiling above the basement.

The collection of samples from the ceiling structure was abandoned because the intended use of the Warehouse building and the scope of work planned to be performed to bring it to the proper technical condition are currently unknown.

If the building was to be used as a warehouse, it is very likely that, taking into account current calculation procedures, it will be necessary to strengthen the elements of the ceiling structure above the basement.

To sum up, it was found that the ceiling above the basement of the Warehouse building required renovation and repair work.

A completely technically and economically justified solution, and at the same time recommended from a technical and economic point of view, was the demolition of the existing ceiling above the basement, which had corrosion damage, and the possible subsequent use of fragments (elements of the original structural system as non-load-bearing elements), in accordance with detailed conservation recommendations.

Covering (slab arch with ties)

The structural elements of the building roof, constructed as a slab arch with tie rods, did not show any significant signs of overload. The view from below showed traces of rainwater seeping through the covering, but they were stabilized.

The curved surface of the arch, viewed from the bottom, showed traces of the reinforcing bar cover falling off, which was caused by swelling corrosion of the reinforcement resulting from the moisture of the concrete element.

The covering of the Warehouse building was not insulated from the outside, it was made of thermal felt made in recent years. The roofing felt was tight and there were no visible leaks into the building. The cover was insulated by placing a layer of mineral wool on a wooden soffit suspended from the tie rods. The mineral wool was laid on boards, without a vapor barrier due to the use of mineral wool boards with an aluminum screen that acted as a vapor barrier and a thermal screen from the inside of the warehouse building.

There was no visible damage in the places of installation (suspension) of the reinforced concrete posts to the bottom of the slab arch surface - no detachment of the posts from the roof surface was observed. The connections of the posts with the tie rods were also undamaged - there were no visible scratches. During the inspection, no buckling of either the posts or the tie rods was found. In the place where the slab arch rests on the longitudinal walls, in the view from the bottom of the covering, no damage in the form of cracks or scratches was identified.

Based on the visual assessment and simplified measurements made using a Schmidt type N hammer, the concrete in the roof structure of the Warehouse building was determined to be class C16/20 (B20) concrete. The homogeneity of the concrete was determined to be good.

To sum up, it was found that the covering of the Warehouse building in the form of a slab arch with tie rods required renovation and repair work.

A completely technically and economically justified solution, and at the same time recommended from a technical and economic point of view, was the demolition of the existing roofing constructed as a slab arch with ties and the possible subsequent use of fragments of the original elements, in accordance with detailed conservation recommendations.

Joinery (windows and doors)

The windows in some rooms on the ground floor were replaced with wooden ones glazed with insulated glass during the building's operation. However, in most rooms the windows were made of steel frames glazed with single glass: the panes were scratched and the frames showed signs of surface corrosion. The movable quarters of the steel frames were in most cases damaged and could not be opened or opened with great difficulty. The window openings in the basement were bricked up in recent years.

The interior door joinery in the rooms on the ground floor was contemporary with wooden door leaves. The external door joinery consisted of modern wooden doors and steel gates. The door joinery showed intensive decapitalization - wooden elements were mechanically damaged and steel elements were corroded.

To sum up, the window and door joinery in the entire warehouse building required renovation and repair work.

A completely technically and economically justified solution, and at the same time recommended from a technical and economic point of view, was the demolition of the existing window and door joinery elements and the possible subsequent use of fragments of the original elements, in accordance with detailed conservation recommendations.

Pipe and cable installations

In the building that had its technical condition assessed, the industry installations: pipes (water supply, central heating) and cables (electrical installation) were partially dismantled. From a functional point of view, the installations were inoperable.

The installations were carried out in accordance with the construction standards applicable in previous years.

To sum up, the pipe and cable installations in the area of the Warehouse building required possible reconstruction according to modern technical solutions during the planned renovation and repair works.

A solution that is completely technically and economically justified, and at the same time recommended from a technical and economic point of view, is the demolition of the existing elements of pipe and wire installations and the possible subsequent use of fragments of the original elements, in accordance with detailed conservation recommendations.

Table 2. Estimated assessment of the degree of decapitalization of the Warehouse building

No.	Building elements	Total share of an item in the building [%]	The degree of decapitalization of the element [%]	The degree of decapitalization of the building as whole [%]
1	Foundations	4.29	70	3.00
2	Brick walls (*basement, ground floor*)	19.65	85	16.70
3	Inter-story ceiling (*above the basement*)	26.44	80	21.15
4	Roof (*slab arch with ceiling lining*)	9.53	65	6.19
5	Partition walls	7.31	70	5.12
6	Interior plasters	4.24	80	3.39
7	Window joinery	4.82	95	4.58
8	Door joinery	3.35	90	3.02
9	Painting works	2.75	95	2.61
10	Floors and tiles	4.01	95	3.81
12	Heating installation	3.94	95	3.74
13	Electrical installation	4.54	95	4.31
14	Water and sewage installation	3.82	95	3.63
15	Locksmith and blacksmith elements	0.75	100	0.75
16	Various elements	0.56	100	0.56
	Σ	100		**82.57**

4.2. Analysis of the Costs of Renovation and Repair Works of the Warehouse Building

Table 2 contains an analysis of the degree of decapitalization of the Warehouse building, carried out using a simplified method, commonly used in engineering practice, based on a visual assessment of the degree of wear of individual building elements.

Based on the assessment, the estimated degree of decapitalization of the Warehouse building was ~83% and exceeded 75% of the building's replacement value, usually assumed as the threshold of economic profitability of implementing an investment project in the form of renovation, including reconstruction and expansion as well as the ultimate modernization of the facility.

Therefore, it could be concluded that in the case of the Warehouse building, a major renovation of the facility located in the former shipyard area was completely beyond the scope of economic profitability.

At the same time, it should be noted that in the case of objects that are monuments or in the case of objects located in an area under conservation protection, in justified cases it may be necessary to carry out renovation works, even if their value exceeds the replacement value.

5. Proposals for the Scope of Renovation and Modernization Works

The analysis of the possibility of further use of the warehouse building located in the former shipyard area was carried out in terms of:

- technical assessment of the feasibility of implementing the scope of renovation works,
- assessment of the economic profitability of their implementation.

For technical reasons, it was possible to carry out construction works in the area of the Warehouse building as part of:

- OPTION 1 - demolition of the warehouse building, leaving the so-called witnesses of history,
- OPTION 2 – general renovation of the Warehouse building,
- OPTION 3 – relocation of the Warehouse building and its general renovation.

The optimal solution, taking into account economic conditions and the previously mentioned technical conditions, as well as enabling the preservation of the historical values of the facility, was the implementation of construction works according to OPTION 1 - demolition of the Warehouse building, leaving the so-called witnesses of history.

The possible preservation of elements with conservation (historical) values would be determined by detailed conservation and architectural recommendations.

It was estimated, taking into account the technical condition of the Warehouse building, that for the scope of construction works adopted in OPTION 1, it was possible to re-use the existing building substance (construction and finishing elements) by building them into the newly constructed facility as the so-called witnesses of history theoretically may fluctuate around 30%.

The implementation of construction works according to OPTION 1 fully enabled the implementation of the investment plan consisting in the construction of a production hall in the current location of the warehouse building.

For the case of OPTION 1 - demolition of the warehouse building, leaving the so-called witnesses of history, construction works had to be carried out in the following scope:

- develop conservation and architectural documentation based on detailed guidelines. The developed documentation should clearly indicate the elements intended to be used as the so-called witnesses of history,
- develop a detailed demolition design,
- based on the developed demolition design, demolish the existing building,
- the demolition project should be developed taking into account:
  - ❖ expected threats occurring during construction works, specifying the scale and type of threats as well as the place and time of their occurrence,
  - ❖ noise emission and its impact on the natural environment,
  - ❖ emission of pollutants and its impact on the natural environment,
  - ❖ waste generation and their impact on the natural environment (including the division into safe and hazardous waste),

  - threats to human safety and health,
  - method of conducting training for employees before carrying out particularly dangerous works,
  - the implementation of demolition works must be carried out in accordance with applicable occupational health and safety (OSH) and fire protection (fire protection) regulations, in particular in compliance with the requirements specified in the regulations specified below [N1]÷[N9],
- when developing a detailed demolition project, attention should be paid to the problem of dismantling a slab arch: it is recommended to dismantle it by cutting the coating with a diamond saw, starting from the gable wall, into strips ~100 cm wide. After dismantling the fragments of the coating without the tie, in the fragment prepared for demolition (cut out) with the tie, it should be cut at the supports, which are the longitudinal walls. The freely hanging reinforced concrete tie should be cut into ~100 cm long sections, and then the freely hanging reinforced concrete posts should be cut off from the coating. After cutting them off, continue dismantling the coating as in the case of the previous fragments without the tie,
- taking into account the currently applicable regulations, the demolition of the Warehouse building is possible on the basis of an administrative decision, the so-called demolition permit issued by the local administrative authority,
- develop detailed, multi-discipline technical documentation of the newly designed facility - production hall,
- the developed design of the production hall must take into account the fulfillment of the currently applicable standard conditions in structural elements for both the *Ultimate Limit State* (*ULS*) and the *Serviceability Limit State* (*SLS*),
- the developed design of the production hall must include the so-called witnesses of history in the number and in places indicated in the developed conservation and architectural documentation,
- taking into account the currently applicable regulations, the construction of a production hall is possible on the basis of an administrative decision, the so-called building permit issued by the local administrative authority.

For economic reasons, the implementation of the investment measurement according to OPTION 2 - general renovation of the Warehouse building was highly questionable (doubtful):

- the estimated degree of decapitalization of the building was ~83% and was significantly higher than 75% (83% > 75%) customarily accepted in engineering practice as the limit of economic profitability of renovation,
- implementation of renovation works according to OPTION 2 and the related costs of adapting the building to modern technical and operational requirements (assuming its intended use as a warehouse facility) were in practice difficult to estimate due to the renovation nature of the construction works,
- as a result of renovation works, after incurring costs that are difficult to estimate, you would potentially obtain a facility with significant operational limitations, relating, among others, to the width of communication routes and the lack of an internal staircase,
- there was no guarantee that due to the technical condition of the structural elements, in particular the elements of the ceiling structure above the basement, during renovation works in the building, their technical condition would not rapidly deteriorate, which could result in the need for their partial reconstruction, regardless of the scope of work related to their strengthening.

It was estimated, taking into account the technical condition of the Warehouse building, that for the scope of construction works adopted in OPTION 2, the scope of direct interference (determined only by technical reasons) in the existing building substance (structural and finishing elements) would exceed 70%.

For the case of OPTION 2 - general renovation of the Warehouse building, construction works had to be carried out in the following scope:

- develop detailed, multi-discipline technical documentation in which the design solutions will take into account conservation and architectural recommendations,
- during design work, special attention should be paid to the following issues:
  - foundations - possible strengthening to adapt to the target use as a warehouse facility,
  - ceiling above the basement - reprofiling of corrosion-damaged reinforced concrete elements and their possible strengthening in order to adapt them to the intended use as a warehouse facility,

  - external walls - revitalization of ceramic external walls, including through the use of design solutions ensuring standard thermal and acoustic insulation of vertical partitions,
  - covering in the form of a slab arch - reprofiling of corrosion-damaged reinforced concrete elements and their possible strengthening in order to adapt to the currently applicable standard regulations,
  - pipe and wire installations - installation of industry installations to the extent necessary to ensure operational comfort appropriate to the target use of the facility,
- the developed design for the general renovation of the Warehouse building must take into account the fulfillment of the currently applicable standard conditions in structural elements for both the *Ultimate Limit State* (*ULS*) and the *Serviceability Limit State* (*SLS*),
- the above requirements cannot be met in practice without strengthening the structural elements, due to the fact that the Warehouse building was built in a period when different dimensioning methods and procedures were in force compared to today, including the dimensioning of reinforced concrete sections. It is completely normal and explainable that as knowledge and experience progress, new regulations and standards are introduced and the requirements for new facilities are updated. Existing facilities, including warehouse buildings, including the warehouse building, very often do not meet these requirements in their current state, and yet they have been and often still are in use. With the changes introduced, there arises the problem of assessing the safety of existing structures and their compliance with the introduced requirements,
- the ISO/CD 13822 *Assesment of Existing Structures* standard allows for the building structure to be considered safe based on its previous failure-free use,
- for further considerations, in the event of a possible preparation of documentation for a major renovation of the Warehouse building, it is also very helpful to take into account the analyzes carried out in the publication Brunarski L., Pawlikowski J.: Assessment of the safety of existing structures. *Wydawnictwo Instytutu Techniki Budowlanej*, 4 (116), Warszawa 2000,
- in accordance with the ISO/CD 13822 standard, further operation of the facility is permissible if it is consistent with the current method of use, even if the currently applicable standard provisions indicate an underestimation of the load-bearing capacity of structural elements. An element conditioning further operation is the lack of visible damage to structural elements - in the case of the Warehouse building, this condition was not met:
  - the reinforced concrete structure of the ceiling above the basement, although it did not show any signs of overload, had extensive damage to the concrete cover and visible traces of developed corrosion of the reinforcing bars,
  - the external walls showed scratches and cracks.

  The above scope of damage made it impossible to directly apply the ISO/CD 13822 standard and forced the need to strengthen the structural elements of the Warehouse building. It had to be taken into account that the strengthening of structural elements (ceiling slabs, columns, transoms and internal and external ribs, as well as external walls and the slab arch as an element of the building's covering would require the use of design solutions that would visually interfere with the existing structural solutions,
- taking into account the currently applicable regulations, a major renovation of the Warehouse building is possible on the basis of an administrative decision, the so-called building permit issued by the local administrative authority.

For economic reasons, the implementation of the investment measurement according to OPTION 3 - relocation of the Warehouse building and its general renovation was extremely controversial (very doubtful) and had the nature of experimental activities:

- similarly to OPTION 2, the estimated degree of decapitalization of the building was ~83% and was significantly higher than 75% (83% > 75%) customarily accepted in engineering practice as the limit of economic profitability of renovation,
- the main difficulty and cost in terms of engineering activities in the case of OPTION 3 was the relocation of the Warehouse building, i.e. its transfer to a place that would not interfere with the implementation of the investment intention (stage 1 of construction works planned to be performed according to OPTION 3) - construction of a production hall in the area including the current location of the building Warehouse. It should be mentioned that although activities involving moving buildings have already been carried out, including in relation to historical buildings that are monuments, e.g. the Grochowska toll-gate in Warsaw, the Lubomirski Palace in Warsaw, the Church of Nativity of the Blessed Virgin Mary in Warsaw, Church

of St. Visitations of the Blessed Virgin Mary in Leszno, and are still carried out occasionally, however, these shifts took place and are taking place today over short distances, much smaller than those that would be necessary in the case of the Warehouse building,
- the possible implementation of renovation works is only the 2nd stage of construction works according to OPTION 3, although the related costs of adapting the building to modern technical and operational requirements (assuming its intended use as a warehouse facility) are in practice difficult to estimate due to the renovation works. nature of construction works,
- as a result of renovation works carried out as part of stage 2 of construction works, after incurring costs that are currently difficult to estimate, the result is, as in the case of OPTION 2, a facility with very significant operational limitations, relating, among others, to the width of communication routes and the lack of internal staircase,
- there was no guarantee that due to the technical condition of structural elements, in particular the elements of the ceiling structure above the basement, during renovation works in the building area (as part of stage 2 works), their technical condition would not rapidly deteriorate, which could result in the need to partially replace them reconstruction, regardless of the scope of work related to their strengthening. At the same time, it cannot be ruled out that a very significant deterioration of the technical condition of construction and finishing elements will occur during stage 1 of the works, i.e. during activities related to the relocation of the Warehouse building.

It was estimated, taking into account the technical condition of the Warehouse building, that for the scope of construction works adopted in OPTION 3, the scope of direct interference (determined only by technical reasons) in the existing building substance (structural and finishing elements) would exceed 80%.

For the case of OPTION 3 - relocation of the Warehouse building and its major renovation, construction works had to be carried out in the following scope:
- develop detailed, highly specialized, multi-discipline technical documentation in which the design solutions will take into account conservation and architectural recommendations,
- when planning the location of the potential relocation of the building, one should take into account the intended use of the place and the adjacent areas, where the Warehouse building is to be ultimately located,
- taking into account the currently applicable regulations, the relocation of the Warehouse building is possible on the basis of an administrative decision, the so-called building permit issued by the local administrative authority.

6. Conclusions

The warehouse building was constructed in the early 20th century and was intended to be used as an oil warehouse building in the shipyard.

During many years of operation, the function of the facility was changed several times: it was mainly used as a warehouse for various materials and products used in the shipyard production process, it was used as office and administrative rooms, and recently the building housed a canteen.

Multiple changes in the use of the Warehouse building resulted in the need to carry out adaptation works in its area, the scope of which was limited only to arrangement works, without interfering with the structural system of the facility.

During the assessment of the technical condition, the degree of decapitalization of the facility, both its structural and finishing elements, was increased in relation to the period of use - the building as a whole was, in technical terms, in a state of advanced and progressing during intensive operational decapitalization: this situation concerned primarily damp rooms at basement level.

The direct causes of the existing technical condition of the Warehouse building as a whole were the following factors:
- imperfections of the technical solutions used during its implementation,
- long-term period of very intensive use of the building,
- lack of regular periodic renovations,
- no major renovation of the building has been carried out so far.

During the assessment of its technical condition, the Warehouse building, as a whole, was in a condition that did not pose a direct threat to the safety of the structure and the safety of use.

The optimal solution, taking into account economic conditions and the previously mentioned technical conditions, as well as enabling the preservation of the historical values of the facility, was the implementation of construction works according to OPTION 1 - demolition of the Warehouse building, leaving the so-called witnesses of history.

References

A. Literature on the implementation of buildings in terms of their construction costs and subsequent operation:

[A1] Dziadosz A., Rejment M.: Wybrane aspekty selekcji przedsięwzięć budowlanych. *Archiwum Instytutu Inżynierii Lądowej, Wydawnictwo Politechniki Poznańskiej*, Poznań, 13, 99–107, 2012.

[A2] Dziadosz A., Kapliński O., Rejment M.: Łączne koszty budynku w cyklu życia inwestycji budowlanej. *Wydawnictwo Uczelniane Uniwersytetu Technologiczno-Przyrodniczego w Bydgoszczy*, Bydgoszcz, 127–134, 2015.

[A3] Gajzler M., Puklińska M., Dziadosz A.: Wpływ rozwiązań projektowych na wielkość kosztów w cyklu życia inwestycji budowlanej. *Archiwum Instytutu Inżynierii Lądowej, Wydawnictwo Politechniki Poznańskiej*, Poznań, 13, 123–130, 2012.

[A4] Rejment M., Dziadosz A.: Wybrane aspekty selekcji przedsięwzięć budowlanych z uwzględnieniem oceny ryzyka. *Czasopismo Techniczne*, Kraków, Zeszyt 1-B(5), (111), 221–228, 2014.

B. Publications regarding the principles of conducting the investment process:

[B1] Muczyński A.: Metodyka planowania w zarządzaniu nieruchomościami. *Wydawnictwo Educaterra sp. z o.o.*, Warszawa 2016.

[B2] Połoński M.: Kierowanie budowlanym procesem inwestycyjnym. *Wydawnictwo SGGW*, Warszawa 2018.

C. Literature on cost estimation of renovation and modernization works of buildings:

[C1] Czapla H., Górniecki A., Kaczmarska J., Lapierre Ł., Miśkiewicz M., Sikorska-Ożgo W., Traczyk J., Woźnica J., Wypych A., Żebrowski H.: Metoda uproszczona w kalkulacji kosztorysowej – vademecum kosztorysanta. Zeszyt nr 2. Wydanie 4, zmienione. *Ośrodek Wdrożeń Ekonomiczno-Organizacyjnych Budownictwa PROMOCJA*, Warszawa 2004.

[C2] Czapla H., Górniecki A., Kaczmarska J., Lapierre Ł., Miśkiewicz M., Sikorska-Ożgo W., Traczyk J., Woźnica J., Wypych A., Żebrowski H.: Kalkulacja szczegółowa w kosztorysowaniu robót budowlanych. Zeszyt nr 3. Wydanie 4, zmienione. *Ośrodek Wdrożeń Ekonomiczno-Organizacyjnych Budownictwa PROMOCJA*, Warszawa 2004.

[C3] Czapla H., Górniecki A., Kaczmarska J., Lapierre Ł., Miśkiewicz M., Sikorska-Ożgo W., Traczyk J., Woźnica J., Wypych A., Żebrowski H.: Przykłady kosztorysów robót specjalistycznych – vademecum kosztorysanta. Zeszyt nr 16. Wydanie 5, zmienione. *Ośrodek Wdrożeń Ekonomiczno-Organizacyjnych Budownictwa PROMOCJA*, Warszawa 2009.

[C4] Praca zbiorowa: metody kosztorysowania robót budowlanych. *Wydawnictwo Warszawskiego Centrum Postępu Techniczno-Organizacyjnego Budownictwa, Ośrodek Szkolenia WACETOB sp. z o.o.*, Warszawa 2008.

[C5] Grzyl B.: Kosztorysowanie robót budowlanych. *Wydawnictwo Verlag Dashofer*, Warszawa 2008.

D. Publications regarding the assessment of the technical condition of buildings:

[D1] Baranowski W.: Zużycie obiektów budowlanych. *Wydawnictwo Warszawskiego Centrum Postępu Techniczno-Organizacyjnego Budownictwa, Ośrodek Szkolenia WACETOB sp. z o.o.*, Warszawa 2000.

[D2] Baryłka A., Baryłka J.: Diagnostyka techniczna obiektu budowlanego. *Budownictwo i Prawo*, Warszawa, 19–22, 4, 2015.

[D3] Drobiec Ł.: Badania nieniszczące wykorzystywane w technice budowlanej. *Badania Nieniszczące i Diagnostyka*, 3, 76–80, Warszawa 2018.

[D4] Drobiec Ł.: Techniki diagnostyczne i sprzęt umożliwiające badania obiektów budowlanych. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 241–259, Cedzyna 2022.

[D5] Drozd W.: Analiza katastrof budowlanych w Polsce w latach 2004–2019. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 187–198, Szczecin - Międzyzdroje 2022.

[D6] Halicka A.: Ocena istniejących konstrukcji budowlanych według normy ISO 13822-2010. *V Ogólnopolska Konferencja Problemy techniczno-prawne utrzymania obiektów budowlanych.* Warszawa 2019.

[D7] Hoła J., Runkiewicz L.: Zasady wykonywania ekspertyz konstrukcji żelbetowych. *Wydawnictwo Naukowe PWN*, Warszawa 2020.

[D8] Jaśniok M., Jaśniok T.: Ocena zagrożenia korozyjnego stali w konstrukcjach żelbetowych na podstawie badań diagnostycznych i monitoringu. *XXXVII Ogólnopolska Konferencja Warsztat Pracy Projektant Konstrukcji WPPK-2023*, 605–674, Wisła 2023.

[D9] Kucharska-Stasiak E.: Metody pomiaru zużycia obiektów budowlanych. *Materiały Budowlane*, Warszawa, 2, 29–38, 1995.

[D10] Mazur M.: Prawa i obowiązki uczestników procesu budowlanego przy naprawach i wzmocnieniach konstrukcji w świetle Ustawy Prawo budowlane i rozporządzeń wykonawczych. *XXXVII Ogólnopolska Konferencja Warsztat Pracy Projektant Konstrukcji WPPK-2023*, 31–58, Wisła 2023.

[D11] Niedostatkiewicz M., Majewski T.: Diagnostyka uszkodzeń żelbetowej, monolitycznej ściany w realizowanym budynku wielorodzinnym. *Materiały Budowlane*, Warszawa, 11, 603, 1–5, 2022.

[D12] Obolewicz J., Baryłka A.: Interpersonal communication in construction management engineering. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych*, 1, 39–45, Warszawa 2022.

[D13] Piekarczyk A.: Wykrywanie wad struktury oraz lokalizacja zbrojenia w konstrukcjach żelbetowych metodami nieniszczącymi. *XXXVII Ogólnopolska Konferencja Warsztat Pracy Projektant Konstrukcji WPPK-2023*, 525–604, Wisła 2023.

[D14] Runkiewicz L.: Przyczyny powstawania zagrożeń, awarii i katastrof obiektów budowlanych. *Przegląd Budowlany*, Warszawa, 91, 5, 48–49, 2020.

[D15] Runkiewicz L.: Wybrane przykłady awarii i katastrof obiektów budowlanych w budownictwie ogólnym. *XXXIV Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2019*, Szczyrk 2019.

[D16] Runkiewicz L., Hoła J.: Diagnostyka techniczna konstrukcji żelbetowych. *Inżynieria i Budownictwo*, Warszawa, 7–8, 397–405, 2018.

[D17] Runkiewicz L., Okuń R.: Stosowanie opracowań rzeczoznawczych w budownictwie. *Przegląd Budowlany*, Warszawa, 90, 5, 48–49, 2019.

[D18] Runkiewicz L., Szulc J., Sieczkowski J.: Metoda diagnostyk, napraw i wzmacniania obiektów budowlanych o konstrukcji żelbetowej. *XXXVII Ogólnopolska Konferencja Warsztat Pracy Projektant Konstrukcji WPPK – 2023*, 227–290, Wisła 2023.

[D19] Schabowicz K.: Najnowsze metody nieniszczące wykorzystywane w badaniach w budownictwie. *Badania Nieniszczące i Diagnostyka*, 3, 48–51, Warszawa 2018.

[D20] Srokowski W.: Studia nad metodą określania stopnia zużycia technicznego budynków mieszkalnych. *Wydawnictw Instytutu Gospodarki Mieszkaniowej*, Warszawa 1971.

[D21] Substyk M.: Utrzymanie i kontrola okresowa obiektów budowlanych. *Wydawnictwo ODDK*, Warszawa 2012.

[D22] Szer J., Jeruzal J., Szer I., Filipowicz P.: Kontrole okresowe budynków – zalecenia, wymagania i problemy. *Wydawnictwo Politechniki Łódzkiej*, Łódź 2020.

[D23] Świt G., Krampikowska A., Tworzewski P.: Wykorzystanie metod NDT do pomiaru i morfologii zarysowań w warunkach in-situ. *XXXVII Ogólnopolska Konferencja Warsztat Pracy Projektant Konstrukcji WPPK – 2023*, 369–394, Wisła 2023.

E. Literature on defects and damage to structural systems:

[E1] Arendarski J.: Trwałość i niezawodność budynków mieszkalnych. *Wydawnictwo Arkady*, Warszawa 1978.

[E2] Bukowski B.: Morfologia rys w konstrukcjach betonowych i żelbetowych. *Archiwum Inżynierii Lądowej*, 3, 4, Warszawa 1957.

[E3] Drobiec Ł., Jasiński R.: Diagnostyka konstrukcji żelbetowych, tom 1, *Wydawnictwo PWN*, 2010.

[E4] Drobiec Ł., Jasiński R., Piekarczyk A.: Konstrukcje murowe według Eurokodu 6 i norm związanych, tom 1–3, *Wydawnictwo PWN*.
[E5] Lewicki B., Woźniak K.: Ustroje i roboty budowlane. *Państwowe Wydawnictwo Szkół Zawodowych*, Warszawa 1965.
[E6] Masłowski E., Spiżewska D.: Wzmacnianie konstrukcji budowlanych. *Wydawnictwo Arkady*, Warszawa 2000.
[E7] Mitzel A., Stachurski W., Suwalski J.: Awarie konstrukcji betonowych i murowych. *Wydawnictwo Arkady*, Warszawa 1982.
[E8] Noakowski P: Rysy w żelbecie jako język konstrukcji. Różne formy zarysowania i ich interpretacje. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 155–173, Cedzyna 2022.
[E9] Niedostatkiewicz M.: Dachy, stropodachy, tarasy. Remonty i wzmacnianie. *Polskie Centrum Budownictwa Difin i Muller sp. z o.o.*, 1–178, Warszawa 2016.
[E10] Praca zbiorowa pod redakcją Kamiński M., Jasiczka J., Buczkowski W., Błaszczyński T.: Trwałość i skuteczność napraw obiektów budowlanych. *Dolnośląskie Wydawnictwo Edukacyjne*, Wrocław 2007.
[E11] Praca zbiorowa pod redakcją Kamiński M., Jasiczka J., Buczkowski W., Błaszczyński T.: Współczesne metody naprawcze w obiektach budowlanych. *Dolnośląskie Wydawnictwo Edukacyjne*, Wrocław 2009.
[E12] Rokiel M.: Renowacje obiektów budowlanych. Projektowanie i warunki techniczne wykonania i odbioru robót. *Wydawnictwo Medium*, Warszawa 2014.
[E13] Sokalska A.: Naprawa i ochrona konstrukcji żelbetowych. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2012.
[E14] Ściślewski Z.: Trwałość konstrukcji żelbetowych. *Wydawnictwo ITB*, Warszawa 1995.
[E15] Ściślewski Z.: Ochrona konstrukcji żelbetowych. *Wydawnictwo Arkady*, Warszawa 1999.
[E16] Thierry J., Zaleski S: Remonty budynków i wzmacnianie konstrukcji. *Wydawnictwo Arkady*, Warszawa 1982.
[E17] Urban T.: Wzmacnianie konstrukcji żelbetowych metodami tradycyjnymi. *Wydawnictwo PWN*, Warszawa 2015.
[E18] Kobiak J.: Błędy w konstrukcjach żelbetowych. *Wydawnictwo Arkady*, Warszawa 1971.
[E19] Lewicki B., Woźniak K.: Ustroje i roboty budowlane. *Państwowe Wydawnictwo Szkół Zawodowych*, Warszawa 1965.
[E20] Masłowski E., Spiżewska D.: Wzmacnianie konstrukcji budowlanych. *Wydawnictwo Arkady*, Warszawa 2000.
[E21] Mitzel A., Stachurski W., Suwalski J.: Awarie konstrukcji betonowych i murowych. *Wydawnictwo Arkady*, Warszawa 1982.
[E22] Noakowski P: Rysy w żelbecie jako język konstrukcji. Różne formy zarysowania i ich interpretacje. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 155–173, Cedzyna 2022.
[E23] Niedostatkiewicz M.: Dachy, stropodachy, tarasy. Remonty i wzmacnianie. *Polskie Centrum Budownictwa Difin i Muller sp. z o.o.*, 1–178, Warszawa 2016.
[E24] Praca zbiorowa pod redakcją Kamiński M., Jasiczka J., Buczkowski W., Błaszczyński T.: Trwałość i skuteczność napraw obiektów budowlanych. *Dolnośląskie Wydawnictwo Edukacyjne*, Wrocław 2007.
[E25] Praca zbiorowa pod redakcją Kamiński M., Jasiczka J., Buczkowski W., Błaszczyński T.: Współczesne metody naprawcze w obiektach budowlanych. *Dolnośląskie Wydawnictwo Edukacyjne*, Wrocław 2009.
[E26] Rokiel M.: Renowacje obiektów budowlanych. Projektowanie i warunki techniczne wykonania i odbioru robót. *Wydawnictwo Medium*, Warszawa 2014.
[E27] Sokalska A.: Naprawa i ochrona konstrukcji żelbetowych. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2012.
[E28] Ściślewski Z.: Trwałość konstrukcji żelbetowych. *Wydawnictwo ITB*, Warszawa 1995.
[E29] Ściślewski Z.: Ochrona konstrukcji żelbetowych. *Wydawnictwo Arkady*, Warszawa 1999.

[E30] Thierry J., Zaleski S: Remonty budynków i wzmacnianie konstrukcji. *Wydawnictwo Arkady*, Warszawa 1982.

[E31] Urban T.: Wzmacnianie konstrukcji żelbetowych metodami tradycyjnymi. *Wydawnictwo PWN*, Warszawa 2015.

F. Publications regarding the negative impact of vibrations on structural systems:

[F1] Ciesielski R., Kawecki J., Maciąg E.: Ocena wpływu wibracji na budowle i ludzi w budynkach (diagnostyka dynamiczna). *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 1993.

[F2] Ciesielski R.: Ujęcie obliczeniowe oraz ocena wpływu drgań i wstrząsów ze źródeł zewnętrznych na niektóre typy budowli. *Zeszyty Naukowe Politechniki Krakowskiej*, 1, Kraków 1961.

[F3] Kawecki J.: Diagnostyka dynamiczna konstrukcji zagłębionych w gruncie. *XX Ogólnopolska Konferencja Warsztat Pracy Projektanta Konstrukcji WPPK-2005*, Wisła-Ustroń, 261–272, 2005.

[F4] Kawecki J., Stypuła S.: Błędy w diagnozach dotyczących oceny wpływów dynamicznych na budynki. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, Szczecin–Międzyzdroje, 267–274, 2007.

[F5] Kawecki J., Stypuła K.: Diagnozy a posteriori wpływów drgań drogowych na budynki. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009,* Szczecin–Międzyzdroje, 539–546, 2009.

[F6] Kawecki J., Stypuła K.: Jeszcze raz o błędach w diagnozach dotyczących oceny wpływów dynamicznych na budynki oraz ludzi w budynkach. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013,* Szczecin–Międzyzdroje, 2013.

[F7] Kawecki J., Stypuła J.: Naruszenie wymagań dotyczących zapewnienia ludziom w budynku niezbędnego komfortu wibracyjnego jako stan zagrożenia awaryjnego. *Inżynieria i Budownictwo, Warszawa, 5,* 266–269, 2011.

[F8] Kawecki J., Stypuła K.: Zapewnienie komfortu wibracyjnego ludziom w budynkach narażonych na oddziaływania komunikacyjne. *Wydawnictwo Politechniki Krakowskiej*, Kraków 2013.

[F9] Kawecki J., Tatara K: Procedury uwzględniania wpływu drgań komunikacyjnych na budynki eksploatowane. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 123–142, Cedzyna 2022.

[F10] Runkiewicz L.: Wzmacnianie i zabezpieczanie istniejących obiektów w sąsiedztwie realizowanych budynków plombowych. *Przegląd Budowlany*, 4, 28–38, Warszawa 2008.

[F11] Runkiewicz L., Sieczkowski J.: Problemy techniczne budowy obiektów na terenie gęstej zabudowy. *Przegląd Budowlany*, 9, 18–23, Warszawa 2015.

[F12] Wilde K., Rucka M., Chróścielewski J., Niedostatkiewicz M.: Rozwiązanie przegrody wibroizolacyjnej w budynku zabytkowym narażonym na drgania wywołane ruchem kołowym i szynowym. *Inżynieria Morska i Geotechnika*, 5, 408–411, Gdańsk 2013.

G. Literature on the deformation of the subsoil and the methods and manner of securing buildings located in areas characterized by complicated foundation conditions:

[G1] Gliniecki S.P.: Geotechnika budowlana. *Wydawnictwo Politechniki Białostockie*j, Białystok 2010.

[G2] Godlewski T., Niemyjska M.: Ryzyko geotechniczne w projektowaniu i realizacji głębokich wykopów. *Acta Scientiarum Polonorum, Architektura-Budownictwo, 17, (3),* 27–36, Warszawa 2018.

[G3] Godlewski T., Koda E., Mitew-Czajewska M.: Geotechniczne oddziaływania obiektów w miejskiej przestrzeni podziemnej. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 97–122, Cedzyna 2022.

[G4] Koda E., Godlewski T.: Zasady wykonywania ekspertyz geotechnicznych z uwzględnieniem budynków w zabudowie miejskiej. *XVI Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 81–108, Cedzyna 2018.

[G5] Kumor Ł., Kumor M.: Błędy w rozpoznaniu podłoża i projektowaniu geotechnicznym na przykładzie doświadczeń. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022* (wykład), Wisła 2022.

[G6] Lechowicz Z., Gajewska B., Gajewska K., Wdowska M.: Badania i dobór parametrów podłoża gruntowego do oceny zachowania się budowli. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022*, I, 255–272, Wisła 2022.

[G7] Meyer Z., Kowalów M., Chryścina M., Wróbel-Hen M., Wasiluk A.: Analiza parametrów geotechnicznych podłoża na podstawie próbnych obciążeń. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022*, II, 41–62, Wisła 2022.
[G8] Niedostatkiewicz M.: Usterki i uszkodzenia budynku mieszkalnego jako następstwo błędów projektowych nowo realizowanego sąsiedniego obiektu budowlanego. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009,* Szczecin–Międzyzdroje, 671–678, 2009.
[G9] Niedostatkiewicz M., Majewski T.: Uszkodzenia ścian konstrukcyjnych wielorodzinnego budynku mieszkalnego spowodowane błędami projektowymi i wykonawczymi. *XXVII Konferencja Naukowo-Techniczna Awarie Budowlane – 2015,* Szczecin–Międzyzdroje, 649–656, 2015.
[G10] Paczkowska T.: Niewłaściwe rozpoznanie podłoża przyczyną awarii obiektów budowlanych. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013,* Szczecin–Międzyzdroje, 394–400, 2013.
[G11] Popielski P., Majewski T., Bednarz B., Niedostatkiewicz M.: Deformacje filtracyjne i ich oddziaływanie na osiadanie podłoża na przykładzie zabytkowego obiektu sakralnego. *Materiały Budowlane*, Warszawa, 10, 602, 2–6, 2022.
[G12] Majewski T., Popielski P., Niedostatkiewicz M., Mieszkowski R.: Diagnostyka podłoża gruntowego i fundamentów zabytkowego Kościoła w stanie awarii. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022,* II, 1–40, Wisła 2022.
[G13] Popielski P., Kasprzak A., Bednarz B.: Wykorzystanie wyników monitoringu geotechnicznego głębokich posadowień do weryfikacji modeli numerycznych parametrów gruntu oraz określenia oddziaływania realizowanej inwestycji na obiekty sąsiednie. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022*, II, 157–180, Wisła, 2022.
[G14] Sendkowski J., Tkaczyk A., Tkaczyk Ł.: Oddziaływania geotechniczne za zabudowę sąsiednią w świetle analizowanych przypadków. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 465–474, Cedzyna 2022.
[G15] Szypcio Z.: Pewne problemy oddziaływania wody gruntowej na konstrukcje i podłoże gruntowe. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022*, II, 197–210, Wisła 2022.
[G16] Tarnawski M.: Analiza przypadku osiadań długotrwałych. *XXVIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2017,* Szczecin–Międzyzdroje, 587–594, 2017.
[G17] Tarnawski M.: Awarie budowli posadowionych na iłach. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013*, Szczecin–Międzyzdroje, 442–450, 2013.
[G18] Tarnawski M., Frankowski Z., Godlewski T., Gwizdała K., Kłosiński J., Mieszkowski R., Nowosad A., Saloni J., Słabek J., Szczepański T., Ura M., Wierzbicki J. Wójcik M.: Badania polowe podłoża budowli. *Wydawnictwo Naukowe PWN*, Warszawa 2020.
[G19] Wandzik G., Szojda L., Ajdukiewicz A.: Zabezpieczenie budynków w obszarach ujawniania się nieciągłości deformacji terenu. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, 341–348, Szczecin–Międzyzdroje 2007.
[G20] Wiłun Z.: Zarys geotechniki. *Państwowe Wydawnictwo Naukowe*, Warszawa 1976.

H. Publications regarding the protection of buildings containing structural and finishing elements made of wood:

[H1] Adamczyk K., Brol J., Malczyk A.: Wady podparcia drewnianej konstrukcji dachu w zabytkowym kościele. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013*, 143–150, Szczecin–Międzyzdroje 2013.
[H2] Ajdukiewicz A., Brol J., Hulimka J., Węglorz M.: Awaria wielkopołaciowego dachu o konstrukcji drewnianej. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, 201–206, Szczecin–Międzyzdroje 2007.
[H3] Bajno D.: Utrzymanie i naprawy dachów oraz stropodachów. *XXX Ogólnopolska Konferencja Warsztat Pracy Projektanta Konstrukcji WPPK – 2015*, Szczyrk 2015.
[H4] Bajno D.: Współczesne rozwiązania więźb dachowych i dachów płaskich. *XXXIV Ogólnopolska Konferencja Warsztat Pracy Projektanta Konstrukcji WPPK – 2019,* Szczyrk 2019.
[H5] Bednarz Ł.: Analiza stanu technicznego historycznego budynku byłego kasyna wojskowego. *XXVIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2017*, 145–154, Szczecin–Międzyzdroje 2017.

[H6] Brol J.: Nowoczesne złącza i łączniki w konstrukcjach drewnianych. *XXXIV Ogólnopolska Konferencja Warsztat Pracy Projektanta Konstrukcji WPPK – 2019*, Szczyrk 2019.
[H7] Dunaj P.: Cichy zabójca konstrukcji drewnianych. *XXVIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2017*, Szczecin–Międzyzdroje, 649–656, 2017.
[H8] Hoła J., Makowski Z.: Wybrane problemy dotyczące zabezpieczeń przeciwwilgociowych ścian w istniejących obiektach murowanych. *XXIV Konferencja Naukowo – Techniczna Awarie Budowlane – 2007*, 109–114, Szczecin–Międzyzdroje 2007.
[H9] Hebda L.: Drewno konstrukcyjne zgodnie z EC-5 i krajowymi uwarunkowaniami. *XXXIV Ogólnopolska Konferencja Warsztat Pracy Projektanta Konstrukcji WPPK – 2019*, Szczyrk 2019.
[H10] Kotwica J.: Konstrukcje drewniane w budownictwie tradycyjnym. *Wydawnictwo Arkady*, Warszawa 2005.
[H11] Kubica J., Kałuża M.: O pewnych problemach z ponad stuletnią drewnianą więźbą dachową nad widownią teatru muzycznego. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013*, 167–174, Szczecin–Międzyzdroje 2013.
[H12] Kubik J., Pawlik K.: Porównania pełzania drewna przed i po porażeniu przez mikroorganizmy. *XXV Konferencja Naukowo-Techniczna Awarie Budowlane – 2011*, 1113–1118, Szczecin–Międzyzdroje 2011.
[H13] Leń P.: Poradnik ciesielski. *Wydawnictwo DIETRICH'S*, 2009.
[H14] Michniewicz W.: Konstrukcje drewniane. *Wydawnictwo Arkady*, Warszawa 1958.
[H15] Mielczarek Z.: Budownictwo drewniane. *Wydawnictwo Arkady*, Warszawa 1994.
[H16] Mielczarek Z.: Budownictwo drewniane. *Wydawnictwo Arkady*, 2014.
[H17] Neuhaus H.: Budownictwo drewniane. Polskie Wydawnictwo Techniczne, 2004.
[H18] Nitka W.: Warunki techniczne wykonania i odbioru robót. *Wydawnictwo Stowarzyszenia Dom Drewniany*, Gdańsk 2015.
[H19] Nożyński W.: Przykłady obliczeń konstrukcji budowlanych z drewna. Wydanie drugie zmienione. *Wydawnictwa Szkolne i Pedagogiczne*, Warszawa 1994.
[H20] Policińska-Serwa A.: Warunki techniczne wykonania i odbioru robót budowlanych, konstrukcje drewniane. Część A, Zeszyt 4. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2018.
[H21] Wałach D., Jaskowska-Lemańska J., Czaja J.: Analiza przyczyn katastrofy budowlanej konstrukcji dachowej zespołu pałacowego w Gorzanowie. *XXVII Konferencja Naukowo-Techniczna Awarie Budowlane – 2015*, 219–226, Szczecin–Międzyzdroje 2015.
[H22] Wróblewski B.: Analiza zachowania się dachów o konstrukcji drewnianej w pożarze. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009*, 729–736, Szczecin–Międzyzdroje 2009.

I. Literature on the principles of thermal insulation design and thermal insulation properties of partitions in buildings:

[I1] Bajno D.: Aspekty cieplno-wilgotnościowe przy projektowaniu, wykonywaniu oraz eksploatacji dachów i stropodachów. *Izolacje*, 5, 48–, 2019.
[I2] Bednarczyk K.: Dobór grubości warstwy ocieplenia w loggiach i na balkonach. *Izolacje*, 2, 32–, 2018.
[I3] Domska I.: Styropian hydrofobowy w izolacji cieplnej ścian fundamentowych. *Izolacje*, 5, 66, 2017.
[I4] Fabijańska M., Zaorski R.: Ekologiczne aspekty wykorzystania wybranych materiałów stosowanych jako izolacje termiczne – polemika. *Izolacje*, 2, 2015.
[I5] Feliks M.: Rola termoizolacji w systemach ETICS wobec rosnących wymagań ochrony cieplnej budynków. *Izolacje*, 4, 19–, 2019.
[I6] Frossel F., Oberhaus H., Reiedel W.: Ochrona cieplna budynków. Systemy izolacji ETICS. *Wydawnictwo Polcen*, Warszawa 2019.
[I7] Garecki M.: Nowe wymagania w zakresie izolacyjności przegród budowlanych w systemach ETICS. *Izolacje*, 5, 48–, 2015.
[I8] Gaciek P.: Innowacyjne cechy systemów ETICS. *Izolacje*, 11/12, 62–, 2017.
[I9] Gaciek P., Gaczek M., Garecki M.: Mechaniczne mocowanie systemów ociepleń ETICS – podstawowe założenia, cechy i funkcje łączników mechanicznych oraz systemów ociepleń. *Izolacje*, 2, 19–, 2019.
[I10] Gaciek P., Gaczek M., Garecki M.: Mechaniczne mocowanie systemów ociepleń ETICS – podstawy obliczania z uwagi na oddziaływanie wiatru. *Izolacje*, 9, 34–, 2019.

[I11] Gaciek P., Gaczek M., Garecki M.: Sposoby mocowania ociepleń do powierzchni ścian według technologii ETICS. *Izolacje*, 10, 20–, 2018.

[I12] Godycki-Ćwirko T., Łosicki Z., Niedostatkiewicz L., Matyskiewicz J., Kin M.: Systemowa analiza rozwiązań materiałowo-konstrukcyjnych docieplonych zewnętrznych przegród budynków w aspekcie oszczędności energii-praca badawcza nr 917043. *Politechnika Gdańska, Wydział Budownictwa Lądowego, Instytut Technologii i Materiałów Budowlanych*, Gdańsk 1991.

[I13] Jaroszyński M.: Szary styropian do termoizolacji fundamentów. *Izolacje*, 10, 74–, 2017.

[I14] Jezierski W., Sadowska B.: Zmiany wymaganej izolacyjności cieplnej przegród i ich wpływ na wskaźnik zapotrzebowania na energię użytkową budynku. *Izolacje*, 3, 19–, 2019.

[I15] Kiejna K.: Jak gruby powinien być styropian? *Izolacje*, 7/8, 66–, 2017.

[I16] Krause P.: Deformacja polistyrenu grafitowego – badania w warunkach laboratoryjnych. *Przegląd Budowlany*, 10, 95–102, 2019.

[I17] Krause P.: Uszkodzenia styropianu grafitowego w systemach ociepleń ETICS. *Izolacje*, 4, 28–, 2019.

[I18] Krause P.: Wpływ natężenia promieniowania słonecznego na rozkład temperatury powierzchni polistyrenu grafitowego. *Izolacje*, 6, 28–, 2019.

[I19] Krause P., Steidl T.: Dylatacje w systemach ETICS a izolacyjność termiczna. *Izolacje*, 3, 38–, 2017.

[I20] Krause P., Steidl T.: Projektowanie ocieplenia w obrębie dylatacji budynków. *Izolacje*, 10, 46–, 2018.

[I21] Niedostatkiewicz M.: Błędy projektowe i wykonawcze systemów ociepleniowych w technologii *BSO* (*Bezspoinowy System Ocieplania*) jako przyczyny utrudnień eksploatacyjnych budynków mieszkalnych. Monografia „Wybrane zagadnienia z budownictwa ogólnego”. *Wydawnictwo Europejskiej Uczelni Społeczno-Technicznej*, 137–146, Radom 2014.

[I22] Niziurska M.: Systemy ociepleń ETICS – rozprzestrzenianie ognia przez ściany. *Izolacje*, 3, 30–, 2018.

[I23] Niziurska M.: Wpływ warunków atmosferycznych w trakcie montażu i sezonowania styropianu białego i grafitowego w systemach ETICS. Izolacje, 6, 74–, 2017.

[I24] Niziurska M.: Zastosowanie płyt PUR i PIR w systemach ociepleń ETICS. *Izolacje*, 7/8, 66–, 2018.

[I25] Orlik-Kożdoń B., Szymanowska-Gwiżdż A., Steidl T., Rubin A.A.: Prognozowanie powstawania grzybów pleśniowych na powierzchni przegród budowlanych. *Izolacje*, 1, 34–, 2019.

[I26] Pawłowski K.: Analiza parametrów fizykalnych ścian zewnętrznych po termomodernizacji w świetle wymagań cieplno-wilgotnościowych. *Izolacje*, 7/8, 22–, 2019.

[I27] Pawłowski K.: Czynniki decydujące o jakości wykonania izolacji z płyt styropianowych. *Izolacje*, 9, 28–, 2019.

[I28] Pawłowski K.: Ocieplenie ścian zewnętrznych płytami styropianowymi – wybrane aspekty wykonawcze. *Izolacje*, 3, 35–, 2019.

[I29] Pawłowski A., Andruszkiewicz K.: Analiza wybranych działań termomodernizacyjnych w celu osiągnięcia standardu dla budynku o niskim zużyciu energii. *Izolacje*, 11/12, 24–, 2018.

[I30] Pawłowski K., Lewandowski F., Lewandowski Ł.: Analiza porównawcza rozwiązań materiałowych ścian zewnętrznych i ich złączy w aspekcie nowych wymagań cieplnych. *Izolacje*, 3, 2015.

[I31] Pietruszka B.L., Wasilewska A. W.: Styropian grafitowy – właściwości i zastosowanie. *Izolacje*, 6, 48–, 2015.

[I32] Praca zbiorowa: Detale projektowe dla architektów. *Wydawnictwo Archi-plus Przemysław Markiewicz*, Warszawa 2019.

[I33] Praca zbiorowa pod redakcją Petera Beinhauer: Katalog standardowych rozwiązań projektowych detali dla projektów budowlanych. *Polskie Wydawnictwo Techniczne*, Warszawa 2010.

[I34] Ramczyk M., Pawłowski K.: Uwarunkowania prawne budownictwa niskoenergetycznego dla projektowania i wykonawstwa w Polsce. *Izolacje*, 10, 26–, 2017.

[I35] Robakiewicz M.: Nowa dyrektywa w sprawie charakterystyki energetycznej budynków. *Izolacje*, 11/12, 20–, 2018.

[I36] Tokarski D., Tomaszewski R., Grudniewski T., Ickiewicz I., Żukiewicz-Sobczak W.: Analiza termiczna przegrody ściennej z wbudowanymi elementami imitującymi mostki cieplne. *Izolacje*, 6, 19–, 2019.

[I37] Wanat A.: Oddziaływania zewnętrzne na elewacje ocieplone w technologii ETICS. *Izolacje*, 5, 78–, 2017.

[I38] Wysocki K.: Docieplanie budynków metodą ETICS. *Wydawnictwo KaBe*, Krosno 2018.

[I39] Ziobro H.: Mocowanie mechaniczne materiału termoizolacyjnego w ETICS. *Izolacje*, 3, 82–, 2018.
[I40] Żurawski J., Szymczak J.: Technologie ocieplania ścian a mocowanie na elewacji budek dla ptaków. *Izolacje*, 1, 32–, 2017.

J. Publications on environmental aspects of construction:

[J1] Jeż J.: Drzewa a stateczność budowli posadowionych na gruntach pęczniejących. *Przegląd Budowlany*, Warszawa, 2–3/90, 1990.
[J2] Jeż J.: Przyrodnicze aspekty bezpiecznego budownictwa. *Wydawnictwo Politechniki Poznańskiej*, Poznań 1998.
[J3] Jeż J., Suwalski J.: Wpływ nieprawidłowego zadrzewienia osiedla na rysowanie się ścian budynków. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 221–229, 1996.
[J4] Jeż J., Wojtasik A.: Wpływ drzew na awarię budynku posadowionego na gruncie pęczniejącym. *Inżynieria i Budownictwo*, Warszawa, 7/89, 1989.

K. Literature regarding the assessment of the technical condition of buildings from the past, including monuments, and carrying out renovation and repair works in their area:

[K1] Bartnik G., Bukowski M.: Analiza przyczyny spękań Kościoła parafialnego Św. Rocha w Jazgarzewie. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, Szczecin–Międzyzdroje, 207–212, 2007.
[K2] Białkiewicz A.: Zagrożenia obiektów sakralnych. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 21–32, Szczecin–Międzyzdroje 2022.
[K3] Błaszczyński T., Oleksiejuk H., Firlej E., Błaszczyński M.: Wielostopniowy monitoring i zabezpieczenie budynków pod ochroną konserwatorską przed awarią lub katastrofą. *XXV Konferencja Naukowo-Techniczna Awarie Budowlane – 2011*, 395–402, Szczecin–Międzyzdroje 2011.
[K4] Błaszczyński T., Sielecki P.: Analiza wpływu błędów projektowych i wykonawczych na awarię kamienicy z lat 30-tych XX wieku. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, 213–220, Szczecin–Międzyzdroje 2007.
[K5] Deneka A., Rudziński L., Grochal W.: Adaptacja i modernizacja zabytkowego Spichrza Feuersteina na cele usługowo-handlowe. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 315–324, 1996.
[K6] Drobiec Ł.: Przyczyny awarii i katastrof obiektów zabytkowych. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 33–52, Szczecin–Międzyzdroje, 2022.
[K7] Drobiec Ł.: Przyczyny zniszczeń i sposób remontu murów Bazyliki matki Boskiej Anielskiej w Dąbrowie Górniczej. *Czasopismo Techniczne*, 9, 106, 25–36, Kraków 2009.
[K8] Eckert W., Chmieliński K.: Przyczyny uszkodzeń i propozycje sposobów wzmocnienia gotyckiego kościoła w Bieniowie. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 291–295, 1996.
[K9] Frasunkiewicz-Puchalska J., Tasarek J.: Nadbudowa i modernizacja zabytkowego budynku bankowo-hotelowego. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 325–332, 1996.
[K10] Gajownik R., Jarmontowicz R., Sieczkowski J.: Diagnostyka i metody oceny bezpieczeństwa konstrukcji murowych. *XXII Ogólnopolska Konferencja Warsztat Pracy Projektant Konstrukcji WPPK – 2007*, Szczyrk 2007.
[K11] Gromysz K.: Remonty wychylonych z pionu Kościoła i domu jednorodzinnego. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 155–161, 1996.
[K12] Hebda L., Czeszyński M., Nikodem D.: Skutki braku odpowiedniego zabezpieczenia budynków zabytkowych w okresie przestoju eksploatacyjnego. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 209–218, Szczecin–Międzyzdroje 2022.
[K13] Janowski Z., Hojdys Ł., Krajewski P.: Analiza oraz naprawa i rekonstrukcja sklepień w obiektach historycznych. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, Szczecin–Międzyzdroje, 251–260, 2007.

[K14] Janowski Z., Janowski M.: Awaria zabytkowej hali oraz problemy związane z jej rekonstrukcją. *XXV Konferencja Naukowo-Techniczna Awarie Budowlane – 2011*, 427–436, Szczecin–Międzyzdroje 2011.

[K15] Janowski Z: Problemy konstrukcyjne związane z odbudową Biblioteki Tynieckiej „Wielkiej Ruiny" w Opactwie Tynieckim. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009*, 631–642, Szczecin–Międzyzdroje 2009.

[K16] Kałuża M., Hulimka J., Kubica J.: Stan awaryjny wieży ceglanej w stuletnim budynku uniwersyteckim. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013*, Szczecin–Międzyzdroje, 159–166, 2013.

[K17] Majewski T., Niedostatkiewicz M.: Diagnostyka cienkościennych żelbetowych sklepień kolebkowych w budynku zabytkowym. Część 1. *Przegląd Budowlany*, Warszawa, 11–12, 2–6, 2022.

[K18] Majewski T., Niedostatkiewicz M.: Diagnostyka cienkościennych żelbetowych sklepień kolebkowych w budynku zabytkowym. Część 2. *Przegląd Budowlany*, Warszawa, 1–2, 122–126, 2023.

[K19] Majewski T., Niedostatkiewicz M.: Uszkodzenia pożarowe dachu budynku kościoła pw. Świętych Apostołów Piotra i Pawła. *Przegląd Budowlany*, Warszawa, 9, 603, 2–6, 2021.

[K20] Malczyk A.: Uszkodzenia i sposoby napraw konstrukcji murowej wież zabytkowej bazyliki. *XXV Konferencja Naukowo-Techniczna Awarie Budowlane – 2011*, 477–484, Szczecin–Międzyzdroje 2011.

[K21] Matysek P., Witkowski M.: Badania wytrzymałości i odkształcalności XIX-wiecznych murów ceglanych. *XXVI Konferencja Naukowo-Techniczna Awarie Budowlane – 2013*, Szczecin–Międzyzdroje, 183–190, 2013.

[K22] Minch M., Trochanowski A.: Wybrane zagadnienia wzmocnienia konstrukcji zabytkowego pałacu w Dobrzycy. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 297–306, 1996.

[K23] Mrozowicz J., Gawron K.: Remont budynków czynszowych w historycznej zabudowie śródmiejskiej. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 333–339, 1996.

[K24] Niedostatkiewicz M.: Błędy realizacji prac remontowych przyczyna uszkodzeń wilgotnościowych zabytkowego budynku Sali BHP w Gdańsku. *Builder*, 9, 290, 50–53, Warszawa 2021.

[K25] Niedostatkiewicz M.: Building modernization located in the conservation protection zone in the aspect of technical conditions. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych*, 1, 58–74, Warszawa 2022.

[K26] Niedostatkiewicz M.: Mało znane rozwiązania konstrukcyjne oraz funkcjonalno-użytkowe budynków w powojennej Gdyni. Wybrane przykłady. *Wydawnictwo Bernardinum*, 1–112, Gdynia 2023.

[K27] Niedostatkiewicz M.: Modernizm w Europie – modernizm w Gdyni. Architektura XX wieku i jej waloryzacja w Gdyni i w Europie: Zagadnienia remontowe modernistycznych budynków mieszkalnych na terenie Działek Leśnych w Gdyni. *Wydawnictwo Miasto Gdynia*, 295–298, Gdynia 2017.

[K28] Niedostatkiewicz M., Majewski T.: Bazylika pw. Św. Mikołaja w Gdańsku jako przykład monitoringu i diagnostyki zabytkowych obiektów kubaturowych. *XVII Konferencja Naukowo-Techniczna Warsztaty Pracy Rzeczoznawcy Budowlanego*, 97–122, Cedzyna 2022.

[K29] Niedostatkiewicz M., Majewski T.: Bunker demolition located in a conservation protection zone in the light of technical, national defense, functional-utility and economic conditions. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych*, 4, 1–11, Warszawa 2022.

[K30] Niedostatkiewicz M., Majewski T.: Demolition of the cereal elevator building located in the conservation protection zone in the aspect of technical, functional-utility and economic conditions. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych*, 3, 55–65, Warszawa 2022.

[K31] Niedostatkiewicz M., Niedostatkiewicz L.: Modernizm w Europie – modernizm w Gdyni. Architektura pierwszej połowy XX wieku i jej ochrona w Gdyni i w Europie: Obiekty – pomniki gdyńskiego tempa budowania okresu powojennego. *Wydawnictwo Miasto Gdynia*, 299–302, Gdynia 2011.

[K32] Niedostatkiewicz M., Niedostatkiewicz L.: Modernism in Europe – modernism in Gdynia. 20th century architecture until the 1960s and its preservation: The Monuments of Gdynia Post-War Construction Pace. *Wydawnictwo Miasto Gdynia*, 289–291, Gdynia 2015.

[K33] Niedostatkiewicz M., Niedostatkiewicz L.: Zapomniane konstrukcje młodej Gdyni. *International Workshop City of tomorrow and cultural heritage – Pomerania outlook*, 1, 17–26, Gdańsk 2005.

[K34] Niedostatkiewicz M., Majewski T., Baryłka A.: Renovation works in buildings in the area of former defensive fortifications. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych*, 1, 1–21, Warszawa 2023.

[K35] Nowogońska B.: Diagnoza stanu technicznego willi secesyjnej. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 339–346, Szczecin–Międzyzdroje 2022.

[K36] Ogorzałek A., Żyrek T.: Wzmacnianie fundamentów obiektów historycznych – geotechniczna rutyna czy ekwilibrystyka. *XXXVI Ogólnopolskie Warsztaty Pracy Projektanta Konstrukcji WPPK – 2022*, Wisła, II, 129–156, 2022.

[K37] Owczarek M., Sadowska B., Baryłka A., Kucherowski M.J.: Application of thermal insulating plaster for retrofitting of a building under conservation protection. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych*, 2, 17–25, Warszawa 2023.

[K38] Paczkowska T., Paczkowski W.: Wzmocnienie elementów konstrukcji nośnej pod zwiększone obciążenia użytkowe. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 141–140, 1996.

[K39] Podhorecki A., Dobiszewska M., Sobczak-Piąstka J., Podhorecki P.: Różne problemy inżynierskie związane z oddziaływaniem budowy wielkokubaturowego obiektu budowlanego na istniejące budynki. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, 465–472, Szczecin–Międzyzdroje 2007.

[K40] Podhorecki A., Dobiszewska M., Sobczak-Piąstka J.: Negatywne skutki źle przygotowanej i prowadzonej budowy w strefie staromiejskiej. *XXV Konferencja Naukowo-Techniczna Awarie Budowlane – 2011*, 493–500, Szczecin–Międzyzdroje 2011.

[K41] Podhorecki A., Sobczak-Piąstka J., Dobiszewska M., Izdebski M.: Diagnostyka zabytkowej synagogi w Bydgoszczy. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009*, 679–686, Szczecin–Międzyzdroje 2009.

[K42] Podolski B., Bober W.: Zagrożenia bezpieczeństwa w kwalifikowanych do remontu budynkach starej zabudowy. *VII Konferencja Naukowo-Techniczna Problemy Remontowe w Budownictwie Ogólnym*, Wrocław–Szklarska Poręba, 231–236, 1996.

[K43] Radziszewska-Zielina E., Fedorczuk-Cisak M., Steidl T.: Wybrane aspekty diagnostyki i remontu sakralnych obiektów zabytkowych. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 243–254, Szczecin–Międzyzdroje 2022.

[K44] Rouba B.J.: Zawilgocenie-problem opiekuna Kościoła. *Materiał niepublikowany, przekazany Radzie ds. Kultury i Ochrony Dziedzictwa Kulturowego Konferencji Episkopatu Polski, wersja z roku 2017, uaktualniona w roku 2018 i 2019, Uniwersytet Mikołaja Kopernika w Toruniu, 1–42, 2017–2019*.

[K45] Sekunda R., Szer J.: Awaria i katastrofa budowlana w dwóch remontowanych budynkach. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 255–266, Szczecin–Międzyzdroje 2022.

[K46] Stawiska N., Stawiski B.: Rewaloryzacja murów w obiektach zabytkowych. *Wiadomości Konserwatorskie*, 11, 18–22, Kraków 2005.

[K47] Tajchman J., Jurecki A.: Historia technik budowlanych. Fundamenty, rusztowania, mury, więźby, sklepienia. *Wydawnictwo Naukowe PWN SA*, Warszawa 2020.

[K48] Tkacz P.: Ocena wytrzymałości na ściskanie konstrukcji murowych z uwzględnieniem badań in situ-rozprawa doktorska. *Zachodniopomorski Uniwersytet Technologiczny w Szczecinie*, 1–118, Szczecin 2015.

[K49] Topolnicki M.: Podchwycenie i wzmocnienie fundamentów kościoła św. Jana w Gdańsku metodą iniekcji strumieniowej. *Materiały Międzynarodowego Seminarium CURE „Rewitalizacja budowli miejskich”*, Gdańsk, 17–19.06.2004.

[K50] Trochonowicz M.: Wilgoć w obiektach budowlanych. Problematyka badań wilgotnościowych. *Budownictwo i Architektura*, 7, 131–144–36, Lublin 2010.

[K51] Wałach D., Jaskowska-Lemańska J., Dybeł P.: Analiza przyczyn powstania uszkodzeń kościoła pod wezwaniem Podwyższenia Krzyża Świętego w Podlegórzu. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009*, 239–248, Szczecin–Międzyzdroje, 2009.
[K52] Wałach D., Jaskowska-Lemańska J.: Stan zachowania zabytkowych konstrukcji murowych – studium przypadku. *Builder*, 11, 74–77, Warszawa 2016.
[K53] Wandzik G., Szojda L., Ajdukiewicz A.: Zabezpieczenie budynków w obszarach ujawniania się nieciągłości deformacji terenu. *XXIII Konferencja Naukowo-Techniczna Awarie Budowlane – 2007*, 341–348, Szczecin–Międzyzdroje 2007.
[K54] Wesołowski M.: Zagrożenia starych budynków w sąsiedztwie nowej zabudowy. *XXIV Konferencja Naukowo-Techniczna Awarie Budowlane – 2009*, 721–728, Szczecin–Międzyzdroje 2009.
[K55] Zgorzelski B., Szer J.: Najczęstsze uszkodzenia w budynkach zabudowy śródmiejskiej Łodzi z lat 1890–1920. *XXX Konferencja Naukowo-Techniczna Awarie Budowlane – 2022*, 689–702, Szczecin–Międzyzdroje 2022.

L. Publications on issues related to military buildings, in particular fortifications implemented in the past:
[L1] Bochenek R.H.: Twierdza Modlin. *Wydawnictwo Bellona*, 2003.
[L2] Bochenek R.H.: 1000 słów o inżynierii i fortyfikacjach. *Wydawnictwo Ministerstwa Obrony Narodowej*, Warszawa 1980.
[L3] Laprus M.: Leksykon wiedzy wojskowej. *Wydawnictwo Ministerstwa Obrony Narodowej*, Warszawa 1979.

M. Selected standards and recommendations for the implementation of buildings in the aspect of the requirements of detailed regulations:
[M1] PN-B-03020 *Posadowienie bezpośrednie budowli. Wymagania i obliczenia*.
[M2] PN-B-03002:1999 *Konstrukcje murowe. Projektowanie i obliczanie*.
[M3] PN-B-02025: 2001: *Obliczanie sezonowego zapotrzebowania na ciepło do ogrzewania budynkach mieszkalnych i zamieszkania zbiorowego.*
[M4] PN-82/B-02402 *Ochrona cieplna budynków*. *Wymagania i obliczenia*.
[M5] PN-85/B-02170:2016: *Ocena szkodliwości drgań przekazywanych przez podłoże na budynki*.
[M6] PN-85/B-02171:2017: *Ocena wpływu drgań na ludzi w budynkach*.
[M7] PN-EN 1991-1-1 *Oddziaływania na konstrukcję. Część 1-1: Oddziaływania ogólne. Ciężar objętościowy, ciężar własny, obciążenia użytkowe w budynkach.*
[M8] PN-EN 1991-1-3 *Oddziaływania na konstrukcje. Część 1-3: Oddziaływania ogólne – obciążenie śniegiem,*
[M9] PN-EN 1991-1-4 *Oddziaływania na konstrukcje. Część 1-4: Oddziaływania ogólne – oddziaływania wiatru,*
[M10] PN-EN 1993-1-1 *Projektowanie konstrukcji stalowych. Część 1-1: Reguły ogólne i reguły dla budynków,*
[M11] PN-EN 1995-1-1 *Projektowanie konstrukcji drewnianych. Część 1-1: Postanowienia ogólne i reguły dotyczące budynków*.
[M12] PN-EN 1996 (EC6) (tzw. *Eurokod murowy*).
[M13] PN-EN ISO 6946: *Komponenty budowlane i elementy budynku. Opór cieplny i współczynnik przenikania ciepła. Metoda obliczania*.
[M14] PN-EN ISO 12570 *Cieplno-wilgotnościowe właściwości materiałów i wyrobów budowlanych. Określanie wilgotności przez suszenie w podwyższonej temperaturze*.
[M15] PN-EN ISO 14683: *Mostki cieplne w budynkach. Liniowy współczynnik przenikania ciepła. Metody uproszczone i wartości orientacyjne*.
[M16] PN-EN 14630:2007 *Wyroby i systemy do ochrony i napraw konstrukcji betonowych. Metody badań. Oznaczanie głębokości karbonatyzacji w stwardniałym betonie metodą fenoloftaleinową*.
[M17] Instrukcja ITB nr 318/98: Diagnostyka dynamiczna i zabezpieczenia istniejących budynków mieszkalnych przed szkodliwym działaniem drgań na właściwości użytkowe budynków. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 1998.
[M18] Instrukcja ITB nr 376/02: Ochrona zabudowy w sąsiedztwie głębokich wykopów. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2002.

[M19] Instrukcja ITB nr 324/95 *Przykładowe rozwiązania materiałowo-konstrukcyjne energooszczędnych ścian zewnętrznych o współczynniku k≤0,55 W/(m2·K) z elementów drobnowymiarowych*.
[M20] Instrukcja ITB nr 342/96 *Projektowanie i wykonywanie murowanych ścian szczelinowych wydanych przez Instytut Techniki Budowlanej w Warszawie*.
[M21] Instrukcja ITB nr 334/96: Ocieplanie ścian zewnętrznych metodą „lekką". *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 1996.
[M22] Instrukcja ITB nr 334/02: Bezspoinowy system ocieplania ścian zewnętrznych budynków. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2002.
[M23] Instrukcja ITB nr 418/06: Warunki techniczne wykonania i odbioru robót budowlanych, część C: Zabezpieczenia i izolacje, zeszyt 8: Bezspoinowy system ocieplania ścian zewnętrznych budynków. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2006.
[M24] Instrukcja ITB nr 447/09: Złożone systemy ocieplania ścian zewnętrznych budynków (ETICS). Zasady projektowania i wykonywania. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2009.
[M25] Instrukcja ITB: Warunki techniczne wykonania i odbioru robót budowlanych, część C: Zabezpieczenia i izolacje, zeszyt 8: Złożone systemy ocieplania ścian zewnętrznych budynków (ETICS) z zastosowaniem styropianu lub wełny mineralnej i wypraw tynkarskich. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 2019.
[M26] Świadectwo nr 530/94: Metoda „lekka" ocieplania ścian zewnętrznych budynków. *Wydawnictwo Instytutu Techniki Budowlanej*, Warszawa 1994.

N. Selected detailed provisions regarding the implementation of construction works in terms of their safety:
[N1] Rozporządzenie MPiPS z dnia 26 września 1997 r. *w sprawie ogólnych przepisów bezpieczeństwa i higieny pracy*, Dziennik Ustaw nr 129, poz. 844.
[N2] Rozporządzenie MPiPS z dnia 28 maja 1996 r. *w sprawie szczegółowych zasad szkolenia w dziedzinie bhp i higieny pracy*, Dziennik Ustaw nr 62, poz. 285.
[N3] Rozporządzenie MPiPS z dnia 28 maja 1996 r. *w sprawie rodzaju prac, które powinny być wykonane przez co najmniej dwie osoby*, Dziennik Ustaw nr 62, poz. 288.
[N4] Rozporządzenie MGPiOŚ z dnia 28 marca 1972 r. *w sprawie bezpieczeństwa i higieny pracy przy wykonywaniu robót budowlano-montażowych i rozbiórkowych wraz z późniejszymi zmianami*, Dziennik Ustaw nr 24, poz. 142.
[N5] Rozporządzenie M.S.W z dnia 3 listopada 1992 r. *w sprawie ochrony ppoż. budynków, innych obiektów budowlanych i terenów wraz z późniejszymi zmianami*, Dziennik Ustaw nr 102, poz. 507.
[N6] Rozporządzenie MPiOS oraz MZ z dnia 15 maja 1954 r. *w sprawie bezpieczeństwa i higieny pracy przy użytkowaniu butli z gazami sprężonymi, skroplonymi i rozpuszczonymi pod ciśnieniem wraz z późniejszymi zmianami*, Dziennik Ustaw nr 29, poz. 115 z 1954 r., Dziennik Ustaw nr 23, poz. 216 z 1971 r., Dziennik Ustaw nr 75, poz. 846 z 1999 r.
[N7] Rozporządzenie MPiPS z dnia 14 marca 2000 r. *w sprawie bezpieczeństwa i higieny pracy pracowników zatrudnionych przy ręcznych pracach transportowych*, Dziennik Ustaw nr 26, poz. 313.
[N8] Rozporządzenie MPiPS z dnia 28 maja 1996 r. *w sprawie rodzajów prac wymagających szczególnej sprawności psychofizycznej*, Dziennik Ustaw nr 62, poz. 287.
[N9] Rozporządzenie MPiOS, MPC i MZ z dnia 13 kwietnia 1951 r. *w sprawie bezpieczeństwa pracy przy sprężarkach powietrznych wraz z późniejszymi zmianami*, Dziennik Ustaw nr 22, poz. 174, Dziennik Ustaw nr 13, poz. 91 z 1965 r., Dziennik Ustaw nr 24, poz. 142 z 1974 r.

O. Selected detailed provisions regarding the legal aspects of construction:
[O1] Ustawa z dnia 7 lipca 1994 r. *Prawo budowlane*, Dziennik Ustaw nr 15, poz. 139 wraz z późniejszymi zmianami.
[O2] Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 r. *w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie*, Dziennik Ustaw 2002.75.690 wraz z późniejszymi zmianami.
[O3] Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 r. *w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów*, Dziennik Ustaw 2010.109.719 wraz z późniejszymi zmianami.
[O4] Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 16 sierpnia 1999 r. *w sprawie warunków technicznych użytkowania budynków mieszkalnych*, Dziennik Ustaw 1999.74.836.

[O5]Rozporządzenie Ministra Budownictwa i Przemysłu Materiałów Budowlanych z dnia 28 marca 1972 r. *w sprawie bezpieczeństwa i higieny pracy przy wykonywaniu robót budowlano-montażowych i rozbiórkowych*, Dziennik Ustaw 1972.13.91 wraz z późniejszymi zmianami.
[O6]Rozporządzenie Ministra Infrastruktury z dnia 23 czerwca 2003 r. *w sprawie informacji dotyczącej bezpieczeństwa i ochrony zdrowia oraz planu bezpieczeństwa i ochrony zdrowia*, Dziennik Ustaw 2003.120.1126 wraz z późniejszymi zmianami.

P. Selected detailed provisions regarding the legal aspects of construction in relation to buildings that are monuments:
[P1] Rozporządzenie Ministra Kultury i Dziedzictwa Narodowego z dnia 2 sierpnia 2018 r. *w sprawie prowadzenia prac konserwatorskich, prac restauratorskich i badań konserwatorskich przy zabytku wpisanym do rejestru zabytków albo na Listę Skarbów Dziedzictwa oraz robót budowlanych, badań architektonicznych i innych działań przy zabytku wpisanym do rejestru zabytków, a także badań archeologicznych i poszukiwań zabytków*, Dziennik Ustaw 2018.1609 wraz z późniejszymi zmianami.