Difficult Geotechnical Conditions Under the Palace Complex, Case Study from Cianowice, Near Krakow, Poland

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Abstract. The palace complex in Cianowice near Krakow (Lesser Poland, Poland) built around 1890, after 1945 ceased to function as a residential, so the whole building underwent successive devastation. Military activities, ad hoc repairs and long-term shortage of funds in Poland, led to the destruction of the magnificent assumptions. Since 2006, Palace remained completely unsecured and unattended. Performed in 2012-2015 modernization of the historic palace with the expansion of the basement (for residential building multigenerational) has become the occasion for a thorough diagnosis of the prevailing geotechnical conditions and the state of preservation of threads stone and brick walls and vaults chambers basement. Difficult ground conditions, water penetration, lack of insulation of horizontal and vertical has become one of the main causes of the destruction of the foundations and walls of basements. Moisture from the ground, rising damp in the walls (with dissolved salts in it), evaporate causing erosion of the walls. The result it led to the weakening of the structural and breakout layers of walls. The phenomenon has become particularly clear after the geotechnical surveys, excavations and complete discovery of the basement walls. The conducted works related to general technical renovation and restoration, included foundations (lining and insulation), walls, floors and roof. The assumption palace in Cianowice, through appropriate interference with the use of modern and introduction of a new substance, in any manner that emphasizes value and historical monument became possible to restore the important significance of the object and place.

1. Introduction and location of the palace complex in Cianowice

During the age of the world the rapid development of civilization, carrying behind threats leading to degradation of the cultural landscape (including assumptions historic manor palace), presented a contemporary adaptation of the palace in Cianowicach near Krakow helped to rediscover the precious historical heritage.

The complex manor palace was constructed around 1890 and designed by Teodor Talowski, in the style of historicism - in the spirit of English neo-Gothic. The facility is located in the small town Cianowice, located near Krakow, in the province Malopolska (Poland) (Figure 1).

Since 1945, the building ceased to be used as residential. Over the years, they changed its owners, and the whole building underwent successive devastation. Since 2006, building remained completely unprotected and deprived of care (Figure 2).
Conducted by the new owner in 2012-2015 modernization of the monument (the adaptation of residential building multigenerational) restored his importance and stressed its valuable historical values. Extension of the basement became the occasion for a thorough diagnosis of the prevailing geotechnical conditions and the state of preservation of threads stone and brick walls and vaults chambers basement. Difficult ground conditions, water penetration, lack of insulation of horizontal and vertical has become one of the main causes of the destruction of the entire building (Figure 2).

![Palace complex in Cianowice. The Location](image)

2. Program and scope of work
2.1 Conditions caused damages
Due to the efflorescence, moisture, cracks, delamination the plaster, numerous cavities and degrading materials - the building of the palace until 2011 was in a very bad condition. On the conservation status of the palace was influenced by the lack of care and security. As a result, building has been a general degradation and devastation. Particularly visible became moisture and stains occur in parts of the basement of the building (overlapping of biological type). Moisture from the ground, rising damp in the walls (with dissolved salts in it) evaporate, causing erosion of the walls. As a result, it led to the weakening of the structural and breakout layers of walls. This phenomenon has become particularly clear after the geotechnical surveys, excavations and complete discovery of the basement walls [1].

The building for many years did not have drainage. As a result of the action of rainwater created numerous stains, micro, binders and weakening the structure of the plaster. Foundations, basement walls and facades - in a continuous process were exposed to destructive influence of atmospheric phenomena. In the party basement and foundation walls - exposed in open-pit foundation, threads, brick and stone are very strongly moisture and salt content. The walls and ceilings of cellars were significant losses of limestone and brick chipping joints and loss of form. Degradation of surface materials was due to ubiquitous and mutually interacting factors physicochemical and mechanical. Thermal movement (expansion and contraction due to temperature changes) disrupted the expansion coefficient of the materials within the walls. Caused the cracks and micro-cracks, which over time increased in size and were less resistant to temperature and humidity.

2.2 Geological structure, tectonics
In the area of the palace and park in Cianowice (plot No. 402/14), form the geological profile of the upper Jurassic (Oxfordian) and Quaternary (Pleistocene and Holocene). The upper Jurassic (Oxfordian) is educated as limestone of flints with a maximum thickness of about 380 meters. The Upper Jurassic sediments are a product of marine sedimentation and formed by the accumulation and sticking of carbonate skeletons marine organisms (mostly reef). Ceiling of the upper part of the profile jury usually begins with the material resulting from weathering processes, i.e. the loose limestone passing to the
surface in weathered clay limestone. The ceiling of the upper Jurassic in the area of the plot No. 402/14, is located at a depth of about 4 meters below ground level.

The Quaternary (Pleistocene) in the area of the plot Reg. No. 402/14 forms a continuous cover on the works of the older rock substrate and educated as dust (similar Lesso), which are the product of Aeolian transport and sedimentation of very fine quartz grains bonded to calcium carbonate. Tracks Pleistocene in the ceiling are covered with a thin layer (about 0.2-0.4 meters); the Holocene sediments organogenic educated as silty soil, which are the product of mixing the top part of mineral material (loess sediments) with organic matter (plant), distributed by soil organisms and physical factors (atmospheric). In the area of the plot No. 402/14 do not run any zone dislocation (outcrops of faults).

2.3 Hydrogeological conditions
In the analyzed region underground water of usable are connected with the Upper Jurassic (fractured limestones). Stabilized the water table Upper Jurassic aquifer in the area of the palace and park in

Figure 2. Palace in Cianowice, condition before refurbishment, 2011

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Cianowice (plot No. 402/14) is located at the elevation of approximately 337 m above sea level at a depth of about 59-60 meters below ground level and has a character the free.

2.4 Geotechnical characterization of locality
The based on the findings concerning the geological structure of the area of the plot No. 402/14; in the ground this plot designated indicative three packages geotechnical soil:
Package 0 – Quaternary (Holocene) land humus - soils (silt) [H] - mostly little damp (not suitable as a substrate for mounting structures). It is arranged on the surface to form a continuous layer with a thickness of about 0.2-0.4 meters. The soils are classified as a layer of geotechnical 0.
Package I - Quaternary (Pleistocene) glacial land - less cohesive, assigned to soil of "C", i.e. Other land cohesive unconsolidated (The land constitute a substrate suitable for the foundation of the building - at least plastic). The land belongs to the soil very the haughty, very sensitive to frost, particularly while increasing its moisture, and therefore above the depth of frost penetration Always avoid the foundation of the foundation directly on those parcels. In addition, the land is at an excessive water filtration vertical surface dips may possess properties which may result in relatively large and uneven subsidence under load. Therefore, this land while performing their foundation, absolutely must be protected in a sustainable way from excessive moisture. Consolidation and land subsidence in the ground less cohesive foundation, under the conditions of a sustainable balance of soil humidity, will take place during the erection of the building until they reach the total load, and even within a certain period after the commencement of operation of the building, and changes in the conditions of soil moisture; at any time during growth of soil moisture.
Package III – The Upper Jurassic marine sedimentary ground - rocky (constituting the substrate suitable for foundation construction). Deformation of the rock occurs immediately after application of the maximum load.

2.5 Assessment of foundation conditions
In the area of the palace and park in Cianowice (plot No. 402/14), were found favourable ground conditions for foundation and the possible extension or superstructure of buildings, provided to take into account when designing, identified specific geotechnical tests physical and mechanical parameters of land and ruthless preserve its stability in the analyzed area also found the presence of favourable water conditions, there is no groundwater to a depth of at least about 59-60 m. This does not exclude the other hand, periodic zonal moisture silty soil, especially after long periods of rain and snowmelt. Periodically increased humidity silty soil, can cause temporary worsening ground conditions.

2.6 Scope of construction works and conservation
In 2006, the historic palace in Cianowice was performed scientific documents historical and architectural studies basements and facade of the building. The work been planned to take strict conservation threads stone walls and vaults, and cellars elevations [1].

Conducted in 2012-2015 construction works related to general technical renovation and restoration, included foundations, walls, floors and roof of the building.

The result the tests performed and geotechnical excavation pits around the entire building rated the state of foundations and basement walls.

Made lining and insulation of existing foundations. Above the cellar preserves the cradle of brick and ceiling Klein - with new layers of floors. Above the basement, ground and first floors are designed precast reinforced concrete slabs. The total was made the new roof design with modern materials with a covering sheet corrosion-titanium zinc. Reconstructed exterior staircase entrance to the building.

Stone walls and basement vaults chambers (the XIX century, and from the XX century.), were subjected to restoration work. Removed modern bricklaying, created in the course of ad hoc repairs. Preserved to the maximum extent oldest parts made of limestone broken. Exposure earmarked walls and barrel vaulting two chambers basement made of limestone and broken bricks (Figure 3) [1,2,3].
External walls and building facades with sculptural decoration have been strengthened and protected. Chemical studies have identified salinity layers of plaster. Select the items to be replaced. Established restoration plasters. Stratigraphic tests were performed on the presence of the original color of the facade design elements - layers of plaster and interior architectural and sculptural. Very bad condition of plaster on the exterior walls (rotten, salted advancement destructive processes) caused them forging (from the outside and inside walls). Walls purified, crevices and cracks secured plaster refinishing measures enveloping. On the walls of the tower (outside and inside) underwent restoration render layer of KEIM Porosan, certified WTA. In the underground part of the building and approx. 30 cm above ground level - established sealing layer – KEIM Porosan Dichtungsschlamme (Mineral coating material based on cement, fine sand and additives sealing). Rendering coat covering 50% of the substrate thickness up to 5mm - using material KEIM PorosanTrassZementputz - A route cement plaster, spray improves traction in the mundane parts of the building. The cavities, holes and strong inequalities filled and levelled material KEIM-Porosan Ausgleichsputz - to be damp, salty walls. Then two layers of restoration render - KEIM Porosan Trass Sanierputz - plaster based hydraulic lime truss, white cement, sand and additives for high-strength, to be moist saline walls, used inside and outside the building. In order to achieve a uniform surface texture of the facade uses thin-layer plaster lime-cement fibre reinforcing KEIM Universalputz (particle size 0.6 mm) on the tower and insulation system (on grid with glue) [4].

In conclusion, the project at the same time modern and historic residential space based on the integration with the remaining elements of the original, supported by modern means. Introduced new technologies and adapt them to the new standards and technical utility, with a high aesthetic level. The modern concept provides a reconstructed space enriched with a new air space. Especially valuable preserved and renewed structure remains a historical basement space. It meets the high requirements of Conservation and is the area taking into account contemporary needs and tastes owners. The
construction of the object into account the operational requirements and the nature of the historical substance providing the identity of the place.

3. Conclusions
The work carried out (geotechnical studies, overhaul conservation works, technical and construction) using the latest materials and technology influenced the stops tight advanced processes destructive. Resulted in the restoration of the lost strength parameters of individual elements and the foundation of the building. Dried and removed a high level of humidity especially the basement level. Designed room ventilation basements and provided constant monitoring of temperature and humidity. Removed all bricklaying and secondary elements.

According to the conservation program have been kept and preserved to the maximum extent oldest parts of the walls and vaults of the basement (limestone broken) (Figure 3). By strengthening the technical material (as a result of chemical transformation) halted the processes of degradation and restored to the original character and aesthetic appearance of the interior of the palace.

In conclusion that the work carried out compromise was reached between the historical values of the object and its modern function. When using current conditions of technological and functional palace in Cianowice fully restored original residential character.

The modernization and the conversion of the historic palace in Cianowice near Cracow (Lesser Poland, Poland) is a confirmation, that regardless of grade preservation monument through appropriate interference with the use of modern and introduction new substances in the new feature (in any manner that emphasizes value and historical object), it became possible to restore the important significance of the object and place.

In conclusion, it is worth mentioning the words A. Białkiewicz: „(...) as a result of conservatory works, new cultural values characteristic of the present are produced. Old architecture is continuously influenced by contemporariness. That is why is very difficult to answer this question unambiguously: in what sense does it become architecture today? Certainly, it is a separate category but still it is architecture which plays an important role in our cultural landscape” [5].

References
[1] Łukacz B., Łukacz M. J., Palace in Cianowice. The commune Skala. The work program of restoration facade, walls and vaults, part of the basement and door woodwork, Krakow, 2011.
[2] Łukacz M.M., Łukacz M.J., Palace in Cianowice. The commune Skala. Summary of historic elements. Update, Krakow, 2010.
[3] Jasiński L., Projekt budowlany zamienny przebudowy, rozbudowy i nadbudowy budynku dworskiego „Pałac w Cianowicach z wewnętrznnymi instalacjami (wod-kan, gaz, co, wentylacji mechanicznej, instalacj chłodzenia, instalacji energii elektrycznej, niskoprządowa i odgromowa) i kotłownią gazową wraz ze zmianą sposobu użytkowania budynku dworskiego na budynek mieszkalny jednorodzinny dwupokoleniowy oraz towarzyszącą infrastrukturą techniczną, dojścia dojazdy, miejsca postojowe wraz z odwodnieniem liniowym do zbiornika na wody opadowe na działce nr 402/14 w miejscowości Cianowice, gmina Skała, Krakow, 2014, (in Polish)
[4] Gil-Mastalerczyk J., Gil R., Modern adaptation of the palace - the recovered charm and spirit of the monument (to be published).
[5] Białkiewicz A., Old Architecture – today, Technical Transactions iss. 15 Architecture 7-A1, Cracow University of Technology Press, Krakow, 2010, p. 38-42
[6] http://krakowski.e-mapa.net/, [access: 06-2016].