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CREATION OF THE GEODESIGN POLIGONE FOR EXCELLENT OBSERVATIONS BY GROWTH AND DEFORMATIONS OF THE BUILDING IN THE REGION OF PIDHORETSK MONSTERY IN THE LVIV REGION

Yamelynets S., Pristoupa O., Balyan A., Yameleinets A.
Lviv Polytechnic National University

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Formulation of the problem

Pidhirtsi Monastery is located in the Brody district of the Lviv region on the territory of the Plisnensky settlement, which is located in a morphologically complex region, that is, on the top of a plateau isolated by deep ravines and beams at an altitude of 300 to 400 m above sea level and is a sight of architecture of the XVIII century . Due to significant landslides of the slopes of the terrace, the settlements of the monastery, deformations and cracks of buildings began to settle down. This led to the state of emergency of architectural sights. Accordingly, in order to prevent and stop the destruction, it is necessary to carry out a complex of researches by carrying out geodetic works, namely:

- to create methods for determining the periods of measurement of displacement, deposition and deformation;
- to substantiate and create schemes of planned high-rise networks, as well as programs of geodetic measurements;
- construct and produce the required geodetic signs;
- define methods for checking the position of the signs of the reference network;
- to lay ready geodetic signs;
- perform appropriate measurements for the establishment of the reference network (triangulation, polygonomy, geometric leveling);
- measure: the values of horizontal and vertical displacements; the size of the roll and the transfer of the structure; the size of the cracks in the structures.

In addition to geodetic works during measurements of landslides, sediments and deformations of buildings perform the following works:

- studying the physical and mechanical properties of soils as the basis of the structure;
- study of groundwater regimes;
- studying the voltage under the foundation;
- observing the rate of change from the ambient temperature.

Problem statement

Create a geodetic polygon, perform geodetic observations, analyze them and evaluate the dynamics of soil movement and deformations of the complex of buildings and structures on the territory of the Annunciation Monastery of St. Basil the Great in the village. Pidhirtsi Brody district of Lviv region. To monitor planned high-rise networks for the subsequent issuance of recommendations for the further safe operation of buildings and constructions of the monastery.

An analysis of recent research and publications related to the solution of this problem

Since 1999, the problem of sloping phenomena of slopes and deformations of buildings on the territory of the Podgoretsky monastery was carried out by more than 6 geodetic and geological organizations. In the technical reports, conclusions and recommendations were made for measures to address the problem. The executed proposals on anti-landslide measures on the territory of the monastery did not give the desired result; the influence of the main anthropogenic factors that provoked catastrophic activation of landslides did not decrease, but rather increased. For geodetic control there is no planned high-altitude network without which it is impossible to determine the velocity and magnitude of landslides and deformation of structures.

Presenting main material

The research area (see Fig. 1) is located in the part of the steep, ancient sloping slope of the valley of an unnamed stream that flows into the river Bugok. The slope of the valley in this area is convex and limited by deep ravines. From the vertex surface, the terrace is separated by a steep (40-45 °) slope. Its relative excess over the valley of the stream is 50 m. The slope on this site is characterized by the presence of micro-tares, low hills and microfluidics, which indicate the development within its boundaries of landslide processes.

Almost all buildings and structures are in an emergency, the cracks are present both in the outside and in the middle (see Fig. 2.3).

Fig. 1. Territory Podgoretsky monastery

Fig. 2. Photofixation of the crack (deformation) of the building on the territory of Podgoretsky monastery

Fig. 3. Photofixation of the crack (deformation) of the building on the territory of Podgoretsky monastery

Observation of displacements, deposition and deformation of buildings are of great importance for determining the strength and stability of the structure, for the timely prevention of their destruction or timely signal of the onset of an emergency. As a rule, observations are conducted from the beginning of construction by high-precision and systematic geodetic measurements [3, 4]. When the soil is evenly squeezed under the influence of the weight of the structure, the building is settled, which eventually decreases and stops. If the soils fall unevenly, then, depending on their nature and type, creezes, sag, deflection, torsion and rupture of structures may occur. Changes in the spatial position of the structure are called deformations, in the horizontal plane - displacement, in the vertical - deposits. The purpose of geodetic observations of deformations of buildings and structures is to obtain data that characterizes the absolute values of precipitation and displacement, as well as to establish indicators of their changes in time.

Taking into account that the deformation of the Church of the Annunciation of the Blessed Virgin Mary of the Basilian Monastery (see Figs 4, 5, 6) can occur due to the collapse of the building itself and due to landslides, it is decided:

1) to monitor the collapse of buildings and structures.

2) to observe the dynamics of soil movement, that is, their horizontal and vertical displacements.

In order to determine the landslide and deformation of the buildings, as well as their constant monitoring, first of all, it is necessary to create a geodetic polygon of monitoring stations on the territory of Podgoretsky monastery. To date, the previous organizations have not created a planned and high-altitude basis for determining horizontal and vertical displacement of buildings and structures, as well as determining the direction, magnitude and speed of movement of soils in the territory.

Fig. 4. Building of the Temple of the Annunciation of the Blessed Virgin Mary of the Basilian Monastery

Fig. 5. Photofixation of the crack (deformation) of the foundation of the temple building

Fig. 6. Photofixation of the external fracture (deformation) above the entrance to the temple

Accordingly, after the reconnaissance of the area, a plan of high-altitude, planned high-altitude networks was created, where it was planned to manufacture and install points of the main engineering-high-altitude geodetic network of observations on landslides and deformations of buildings (see Figure 7). According to the scheme, it is necessary to lay two reference ground geodetic points (type: soil rapper) [1]; 4 stationary observation stations on one vertex and 2 on the other. The altitude was proposed to be created by leveling the II class. Altitude observations can be done by leveling the II class [2].

Fig. 7. Scheme of engineering and geodetic network in the territory of Podgoretsky monastery

To determine the values of horizontal displacement of soil landslides, perform triangulation and observational observation. The network consists of eight spaces: some of the church buildings are projected and laid in parallel, others are directed toward the ravines to determine the dynamics of soil movement in the ravines. In total there are 87 reinforcement marks for geodetic observations.

Difficulties arose during the laying of points of the geodesic basis. They are connected with the fact that this territory is within the historical and cultural reserve "Ancient Plisnesk". In accordance with Clause 4 of Article 33 of the Law of Ukraine "On the Protection of the Cultural Heritage" [5], in protected archaeological areas it is prohibited to carry out any excavation work without the permission of the relevant body for the protection of cultural heritage. Therefore, the bookmarking sites agreed with the administration of the "Ancient Plisnesk" reserve and were under the supervision of representatives of the organization.

For observing the deformations of buildings and structures, 35 outer wall signs are laid in the foundations of buildings and 22 internal signs in the church floor. The total number of wall signs was 57 pcs.

During the laying of the marks we paid attention to the retaining wall, which is located between the road in the monastery and the slope of the second slope of the terrace. The retaining wall mentioned above was built to keep landslides and soil flushes to the bottom of the ravine. According to the organizer's documentation, it was constructed of 20 mm long bored piles and 40x40 cm in size. The pallets are interconnected with a reinforced concrete wall height of 50 cm above the surface of the ground. However, during the last visual inspection, a number of cracks (see Fig. 8), which progress, in particular, revealed the separation of asphalt pavement of the road from the retaining wall. In this regard, we had installed an additional 20 marks in the said retaining wall to monitor its deformation.

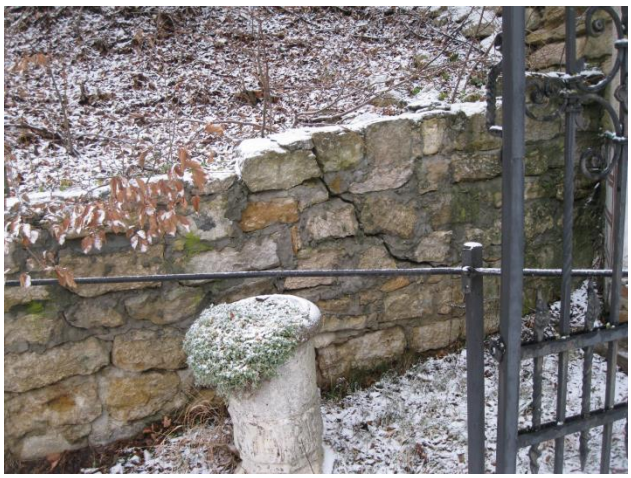

Fig. 8. Photofixation of the crack of the retaining wall of the slope of the terrace

Conclusions

Due to significant landslides of the slopes of the terrace, the buildings and structures of the Podgoretsky Monastery are in a state of emergency. For the rescue of the 18th century architectural monument, which is located in the territory of the Plisnets Reserve, a reference geodetic plan-high-altitude network (landfill) was created. which will allow: to determine the magnitude and direction of landslides; determine the deformation of buildings and structures; determine the size of settling of structures, and also carry out continuous monitoring of these processes.

Consequently, the executors of work on the basis of the conducted cycles of geodetic measurements will be able to give correct advice on strengthening the slopes and stopping further deformations of buildings and structures

Література

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Creating geodetic ground for planned high-altitude observations of landslides and deformations of buildings on the territory of the Pidhirtsi monastery in Lviv region

Yamelynets S., Pristupa O., Balyan A., Yamelynets A.

Projecting and created geodetic polygon for monitoring landslides and deformations of buildings and structures on the territory of the Annunciation Monastery Order of St. Basil the Great in the village. Pidhirtsi, Brody district, Lviv region. So, in the future performers will perform continuous monitoring and control of relevant shifts and deformations and identify effective ways of stopping.