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Hilly Terrain. Features OF High-Altitude Implementation OF Construction Projects

Berezovska A.O.[1], **Nazarenko O.M.**[2*], **Kamenev O.S.**[3], **Kulik M.V.**[4], **Storchai N.S.**[5]
[1, 2, 3, 4, 5] Department of Construction production and project management, National University Zaporizhzhya Politechnic, Zaporizhzhya, Ukraine
Email: [1]Berezovskaja.alna@ukr.net, [2]alexnazar75.an@gmail.com, [3]zbtk1930@ukr.net, [4]starwarskmv4@gmail.com, [5]nadiastorchay@ukr.net

Abstract: *In the scientific work, consider the issue of modelling the surface of hills for the implementation of author's construction projects. Design campaigns and experienced architects can offer ingenious projects based on local reliefs. It is important to take into account the features of lithological characteristics and climatic conditions. Conducting geodetic measurements, especially in hilly areas, gives objective deviations of the surface from the horizontals.*
Researching morphological maps of the relief provides primary information about the geological rocks that make up the area. In the construction industry, there are applied software complexes that allow you to use the geometric dimensions of hills when modelling projects of energy-efficient buildings. Operations are carried out taking into account the entire line of building materials and economical tools. An integrated approach and the possibility of parallel work ensure the actual implementation of the project and the reliability of resource provision.
Keywords: *hill, geodesy, surface, modelling, energy-efficient building, morphological maps.*

1. INTRODUCTION

The space of human thought, the scale of thinking and the endless horizons of picturesque hill landscapes provide inspiration when designing energy-efficient houses. The variety of landscapes offers imagination for experienced designers. The availability of raw mate Hilly terrain. Features of high-altitude implementation of construction projects. Rials for the possible development of compositions of new building materials gives researchers the generation of ideas. Depending on the type of soil and their properties, the design possibilities and geometric dimensions of the foundations are calculated for the existing and developed technical tasks of the developers. In natural conditions, the constant pressure of the masses of the structure leads to compaction of the soil under the foundation and next to it and possible vertical shifts of the structures. In the case of a structure under the foundation, the loads are compressed and the settlement becomes uneven and leads to horizontal shifts, shifts, skews [1], and tilting of buildings. In such situations, cracks appear on the walls, fractures of the walls of buildings [2]. It is important to prevent this; For this purpose, it is possible to use the method of measuring the settlement of the foundations of existing buildings or designing new ones taking into account the magnitude of soil landslides.

In regulatory documents, the requirements for calculating the magnitude of the shift are determined [3] by the mean square error:

- 1mm - for buildings and structures erected on rock and semi-rock soils;
- 2mm - for buildings and structures erected on sandy, clayey and other compressible soils;
- 5mm - for buildings and structures erected on bulk and other subsidence soils.

Loams and sandy loams are characterized by an error of 30 mm, and horizontal soil movement is 10 mm.

The time interval between measurement cycles depends on the type of structures, the rate of deformation. When implementing a construction project, systematic monitoring is performed once or twice a quarter, during the operation period once or twice a year.

Engineering surveys are conducted using geometric, trigonometric leveling, microleveling, possibly photography, stereo photography, and grammetric work.

The marks of deformation points in the measurement cycle are determined relative to the initial reference frame [4]. High-precision levels H05, dashed Invar and special small-sized rails are used for measurements.

Leveling is performed with two horizons of the device, in the forward and reverse directions. When measuring special irregularities of the earth's surface, when drawing a horizontal [5] line on a topographic plan or map,

there will be unequal values between them. This phenomenon is called the change of slopes in their curvature. The smaller the distance between the horizontal lines, the greater the steepness and vice versa.
The angle of inclination of the surface will be determined by the formula:

$$i = tgv\frac{h}{s},$$

where h is the height of the terrain, m
s - terrain foundation, m
From the research it is clear that the greater the embedment between the horizontals, the steeper the slope and vice versa. The steepness of the slope of the terrain according to the topographic map can be determined using special graphs, the scale of embedment. The task of determining the slope slope and reinforcement provides new challenges for territorial planning tasks.
To strengthen the areas that are under a slope, geosynthetics are the most popular. The properties of geotextiles and building structures depend on the brand of plastic and the method of production. If the area is inclined at an angle of less than 50-80 o, then to solve the practical situation, you can plant vegetation with a branched root system. When conducting engineering surveys, effective practical applications are determined for a specific area.
At the stage of preparation for the construction of the facility, it is extremely important to perform geodetic work. Establish a coordinate system and use the necessary technical dimensions of the building in accordance with the project. Taking the benchmark in nature is a rather laborious process that requires sufficient qualification of the surveyor. It makes it possible to establish the height location of the horizontals of the plane and the elevation points of the structures that are planned to be built on the developer's site. Taking the benchmark in nature occurs after a thorough study of the geoplan[6] and compliance with all the wishes of the customer.
Suppose, when constructing a multi-storey building, the builder uses the elevation mark obtained on the site for the construction of subsequent floors. When performing the layout, all lines and points (coordinates x, y) are drawn from the design documentation into the field. To obtain a correct and accurate layout, it is necessary to perform a number of complex measures at the stage of project preparation.
The relief of the terrain plays an important role in the formation of architectural space. On the plains [7], the temperature is more evenly distributed over the surface. They are well warmed by the sun, and temperature fluctuations are felt weakly. In the mountains, the pressure is lower and the temperature is felt. Moist sea air currents can be delayed by the tops of the slopes, which causes a significant difference in the temperatures of neighboring territories. That is why even minimal changes in the relief can affect the microclimate of the area.
In the study of the structure of slopes, an important component is the formation of morphological maps of the relief. In practice, there are two main approaches to the study of morphology - discrete and continuous. The varieties of approaches consist in the dialectical unity of continuous and discontinuous in the structure of the relief on the one hand and different possibilities for studying structures on the other hand.
One example of a discrete morphological [8] model of relief is the morphological triad - a combination of three main elements of the relief of the earth's surface:

- top surfaces of inter-river watersheds or underwater elevations;
- valley bottoms, drainless, lake or river depressions;
- combining their styles.

The morphological triad in existing landforms of any size – from continental ledges and ocean depressions to mesas and microrelief forms.
The volume of the vertex of a relief shape is calculated:

$$V = 1/3(p_{\text{п}} \cdot D \cdot z),$$

where $p_{\text{п}}$ is the area of the upper plane bounding the shape, m^2;
z– excess of the adjacent horizontal, mm;
D - geodetic mark, m.
In any geometric space in the construction industry, transforming data arrays is called building information modeling. Biobjects allow you to accurately plan and analyze a digital model. The software also provides statistical data of directories that form the basis for construction efficiency. The transformation of engineering

survey data opens up new opportunities, allowing you to design and build buildings with great accuracy. Any computerization of construction production increases the profitability of the entire life cycle of the building and provides an advantage for developers and designers.

The specificity of each construction operation and the complexity of the approach to the entire project increase the coordination of all construction processes using existing construction methods and new materials. All possible risks such as unplanned costs: change in terms, quality control create additional benefits for all project participants. Modeling is carried out taking into account the entire line of building materials at each operation and with economical tools [9]. An integrated approach and the possibility of parallel work ensure the actual implementation of the project and the reliability of resource provision. An open platform for the accumulation of statistical data creates comfortable safety conditions and productive opportunities. Design integration creates a database from simple single systems to fully automated buildings. Applied computer programs allow analyzing the benefits of using different types of materials. Supporting energy saving areas involves conducting engineering surveys on the ground, processing experimental research data, and selecting the optimum from a thermal engineering perspective.

Practical data from sloping sites provide spatial opportunities for the implementation of original projects. The use of multi-chamber window profiles of ventilated facades with gap systems in the design and possible special thermal building blocks for walls increase the level of energy efficiency of the house. Building modeling and geodetic survey results provide the project with comfortable living conditions for residents and energy savings.

When developing thermal insulation materials, previous experience and best European practices are studied. Advanced materials that can perform well are flax wool, hermetic foams based on plant components, slag, expanded clay, and aerated concrete can be used for auxiliary premises.

When designing houses in the city of Poltava, we use mineral wool (ρ=125 kg/m^3) and silicate brick ρ=2000 kg/m^3 (2 layers).

Thermal resistance of a layer of a multilayer structure:

$$R_i = \frac{\delta_i}{\lambda_i},$$

where δ_i is the layer thickness, m

λ_i– thermal conductivity coefficient of the material, W/(m·K).

The heat transfer resistance of the enclosing structure R, m^2 · °C/W is determined by:

$$R_\Sigma = \frac{1}{\alpha_в} + \sum_{i=1}^{n} \frac{\delta_i}{\lambda_{i\rho}} + \frac{1}{\alpha_з},$$

$\alpha_в$= 8.7 W/(m^2 ·K);

$\alpha_з$= 12 W/(m^2 · °C);

δ_i– thickness of the i -layer of external walls, m;

$\lambda_{i\rho}$ —calculated thermal conductivity of the material of the outer wall layer under design conditions, W/(m·K).

The standard heat transfer resistance of an external wall with artificial materials is taken to be R norm = 3.3 m^2 · °C/W.

Table 1 – Dependence of the heat absorption coefficient on the type of material

No.	Layer material	Thermal conductivity coefficient, λ, W/(m·K).	Heat absorption coefficient W/(m^2·C)
1	Silicate brick ρ = 2000 kg/m^3	1,63	12,13
2	Mineral wool mats ρ = 135 kg/m^3	0,051	0,66
3	Limestone - sandy plaster	0,81	9,76

We determine the calculated heat transfer resistance of the external walls.

The actual heat transfer resistance of the outer wall R T norm. = 3.43 m^2 ×°C/W.

The thermal inertia of the house is D=5.9. The condition is fulfilled

R T norms. ≤R T s

3.2 ≤3.43.
To compile the heat balance, we take the thermal resistance of the external walls as $R_3C = 3.43\ m^2 \cdot {}^oC/W$.
The use of building materials with increased thermal properties increases the reliability of design energy-active building
The development and design of the houses is positioned as a private partnership with developers. The building project has three floors that are connected by a common wall and each apartment has a separate entrance.
Due to the lack of a single standard for a townhouse, there is not.
There are fewer residents in such a complex than in an apartment building.
Creating your own space goes beyond the physical process of building, the art of translating ideas into a concrete space. Green building focuses on developing and implementing practices that promote energy efficiency, occupant health, carbon reduction, and conservation of natural resources. This approach includes the use of natural materials, innovative technologies, and consideration of natural conditions and landscape. The use of computer modeling allows us to use natural slopes to create original energy-efficient buildings. projects with the support of local producers of energy-efficient building materials.

2. CONCLUSIONS

1. A thorough geodetic reference survey allows you to identify the natural possibilities of the slopes, which are harmoniously embodied in the author's townhouse project.
2. Using thermal engineering calculations, you can obtain optimal energy consumption values of up to 50 kWh/m^2 per year.
3. Stimulation of scientific potential allows for modern energy-saving options for building design solutions.

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