

**GEOTECHNICAL STUDY
NO. 7 / 2020**

On the site in Cluj-Napoca locality, Parc Est, Cluj county

BENEFICIARY: CLUJ-NAPOCA MUNICIPALITY, with registered office in loc.
Cluj-Napoca, county Cluj

GENERAL CONTRACTOR: -

**SPECIALIST CONTRACTOR:
S.C. SOIL TESTING S.R.L. CLUJ NAPOCA**

**SOIL TESTING AND ASSESSMENT LABORATORY - DEGREE II
AUTHORIZATION NO. 3150/19.05.16**

DATE: JANUARY 2020

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Geotechnical study for single-phase project

Technical brief

1. Objective denomination Site

Site Parc Est, on the site in Cluj-Napoca locality, Parc Est, Cluj county.

2. Purpose of paper

Construction authorization Foundation land calculation Foundation sizing

3. Preliminary classification under geotechnical category

With the purpose of the preliminary definition of the geotechnical category, we began from the following terrain conditions:

Factors to be considered	Description	Score
Terrain conditions	Good terrains	2
Underground water	No dewatering	1
Classification of construction based on importance category	Normal	3
Proximities	No risks	1
Geotechnical risk	Low	7
Geotechnical category	1	

According to the calculated score, the paper preliminarily falls under the geotechnical category 1, with reduced geotechnical risk. The classification has been made according to the *Normative regarding the geotechnical documentations for constructions* indicative **NP 074/2014**.

4. Research line

In order to determine the lithological succession, 4 geotechnical drilling works were performed up to a maximum depth of 5.00 m (compared to the natural terrain elevation).

Samples for laboratory testing were collected upon the realization of the works.

The geotechnical study, as a synthesis of the terrain researches, analyzes and details the particularities of the sites in view of the following aspects:

- Foundation land layering;
- The area's hydrogeological regime;
- The physical-mechanic characteristics of the land;
- Presentation of the calculation of the bearing capacity at the level of the foundation base;
- Estimation of absolutely probable deformities;
- Appreciations on the overall stability of the site.

5. Geology and morphology

From a morphological point of view, the perimeter pertains to the structural unit Transylvanian Plateau, with a foundation of metamorphic crystalline schists and sediment deposits up to the Late Cretaceous (Senonian), that supports the stratigraphic succession of the actual plateau, within which see the delimitation of deposits of Paleogene age, continental-lacustrine facies, and Neogene, normal or brackish facies.

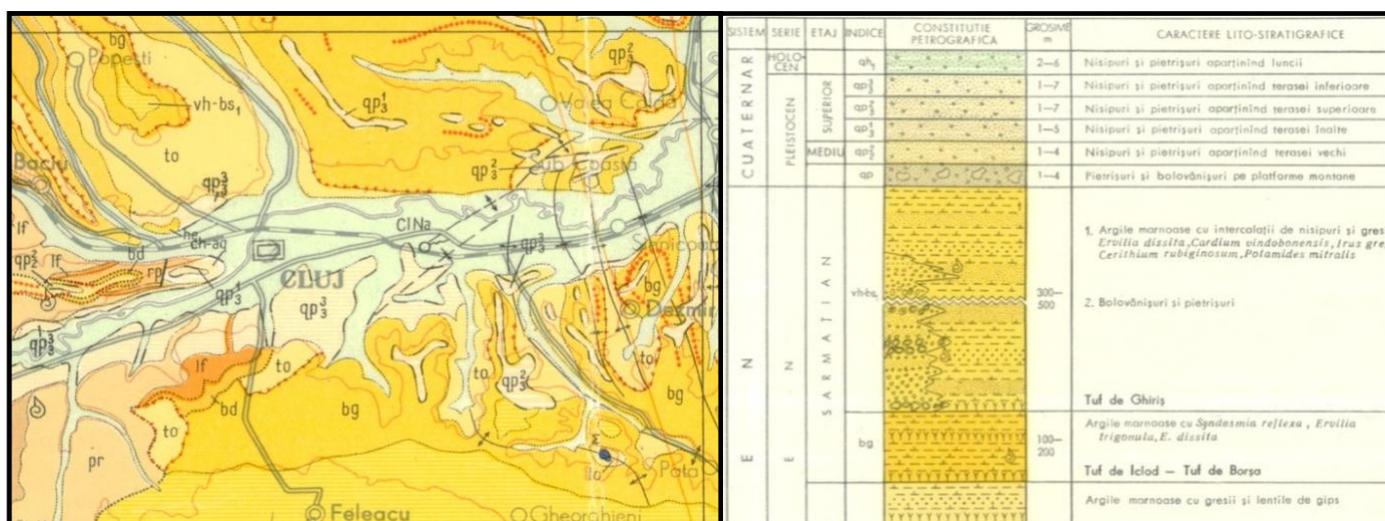


Fig. 1 Geological map of the area

The following granulometric categories have been identified: dusty sandy clay, sandy clay, clay sand, sand. **On the date on which the prospecting works were carried out, no active dynamic phenomena were emphasized.**

6. Land layering

The lithological column identified by means of the geotechnical works presents as follows:

Drilling 1:

- 0.00 (**compared to the natural terrain elevation**) – -1.00 m → Fillings (1)
- -1.00– -2.60 m → Dusty sandy clay, brown, plastic, rich (2)
- -2.60– -4.00 m → Sandy clay, gray, plastic, soft (3)

Drilling 2:

- 0.00 (**compared to the natural terrain elevation**) – -0.20 m → Vegetal soil (1)
- -0.20– -0.80 m → Sandy clay, brown-yellow (2)
- -0.80– -1.50 m → Sandy clay, brown-gray (3)
- -1.50– -2.60 m → sandy, gray (4)
- -2.60– -4.00 m → clay sand, blackish (5)

Drilling 3:

- 0.00 (**compared to the natural terrain elevation**) – -0.15 m → Vegetal soil (1)
- -0.15– -0.60 m → Sandy clay, brown-yellow (2)
- -0.60– -1.00 m → Sandy clay, brown-gray (3)
- -1.00– -1.50 m → Sandy dusty clay, gray (4)
- -1.50– -4.00 m → Sandy dusty clay, blackish, plastic, soft (5)
- -4.00– -5.00 m → Sandy clay, brown, plastic, rich (6)

Drilling 4:

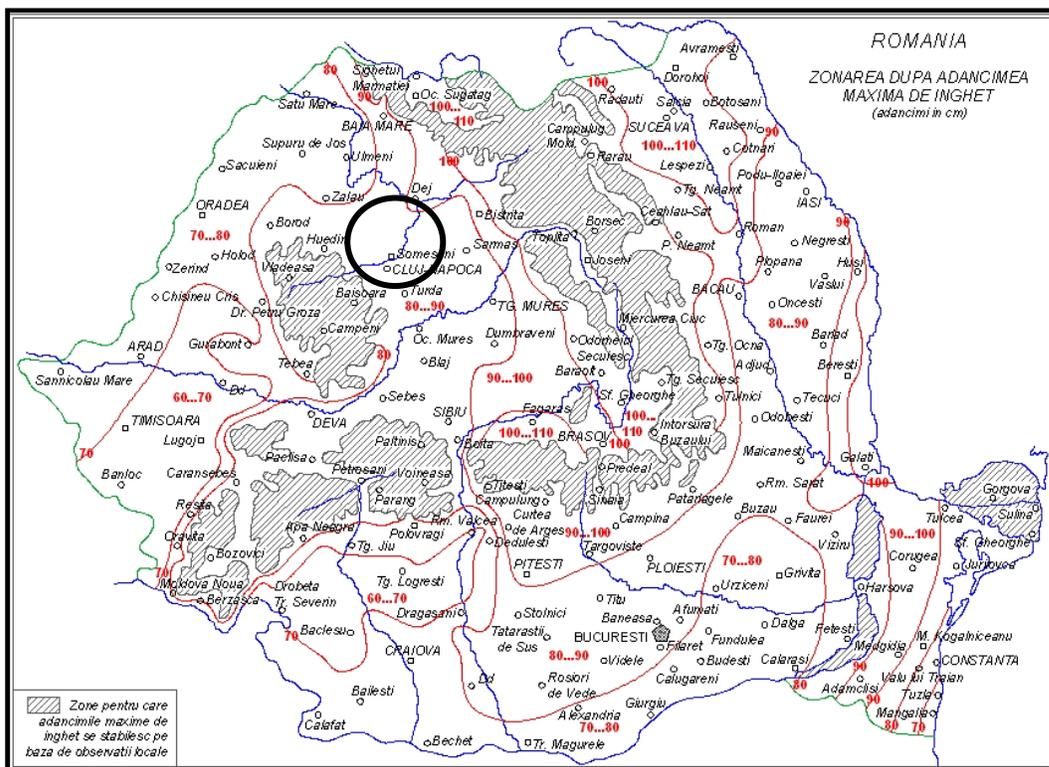
- 0.00 (**compared to the natural terrain elevation**) – -0.25 m → Vegetal soil (1)
- -0.25– -1.30 m → Gravel (2)
- -1.30– -5.00 m → Gravel with sand (3)

7. Underground water

The water was intercepted within the frilling works at a depth of 1.10 m for F2 and 1.00 m for F3.

8. Frost area depth

The moderate continental type climate of the area imposes, according to STAS 6054/77, lowering the foundation base under the maximum frost depth. For the studied site, this means ~0.80 - 0.90 m.



Zoning Romania's territory according to frost depth according to STAS 6054/77 "Maximum frost depths"

9. Seismic area

In according to the technical regulations “**Seismic design code - Part 1 - Design provision for buildings**” indicative **P100-1/2013**, the zoning of the design terrain acceleration, for seismic events with a medium recurrence range $IMR = 225$ years, and a 20% probability of being exceeded in 50 years, the studied area has: - the coefficient a_g equal to **0.10 g**;

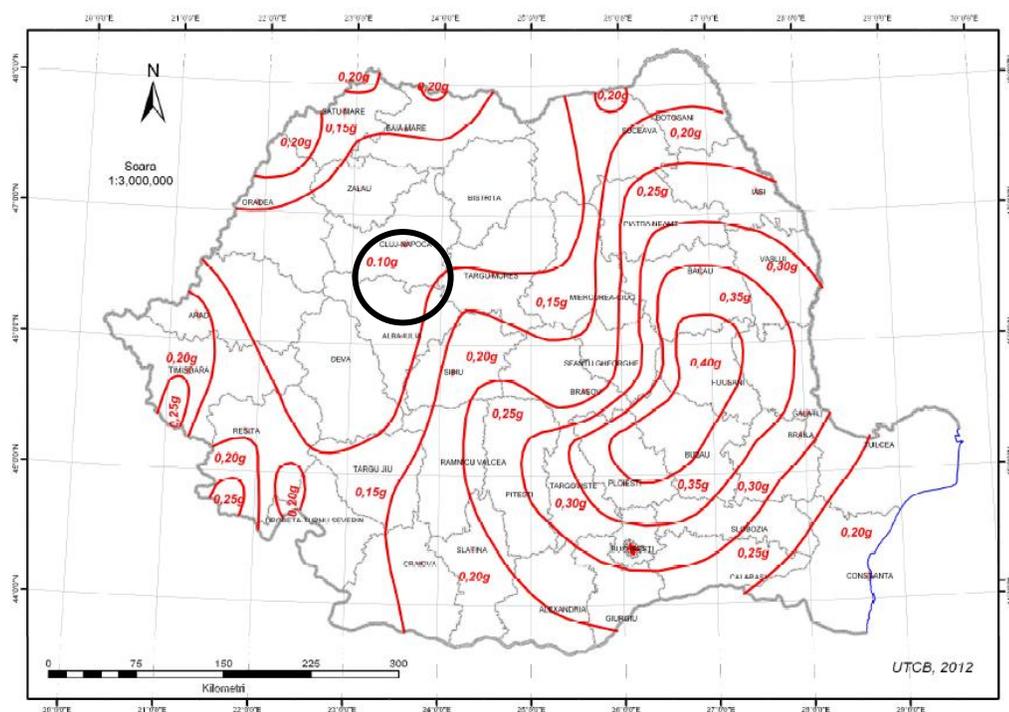


Figure 2. The zoning of peak values of design terrain acceleration a_g with $IMR = 225$ years and a 20% probability of being exceeded in 50 years

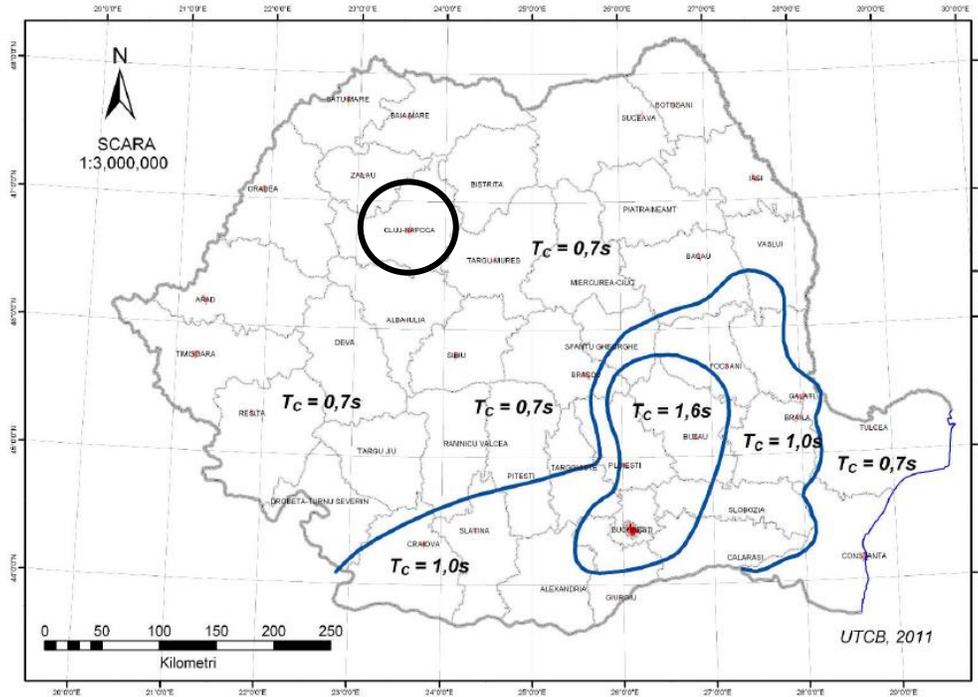


Figure 3. Zoning of Romania’s territory in terms of control period (corner), T_c of answer spectrum

The control period (corner) T_c of the answer range represents the border between the area (landing) of maximum values in the absolute accelerations spectrum and the area (landing) of maximum values in the relative speeds spectrum, and is expressed in seconds. For the studied area, it is:

- T_c (corner period) equal to **0.7 sec.**

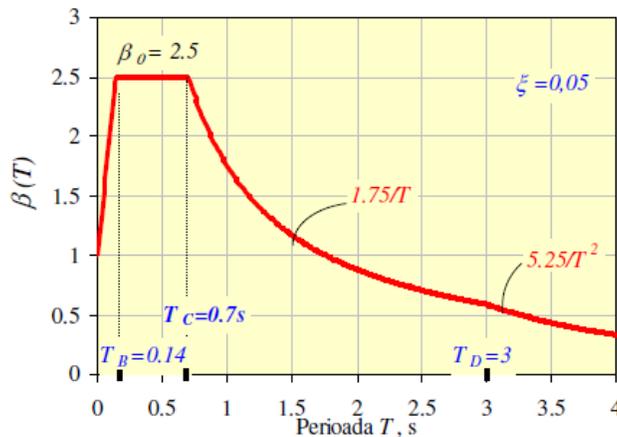


Figure 4. The normalized spectra of the elastic answer of the absolute acceleration for the critical amortization fraction $\xi = 5\%$ under the seismic and land conditions in Romania.

10. Classification of the objective under “risk areas” (earthquake, landslides, floods) that forms the “national territory development plan - SECTION V - RISK AREAS”

Area classification in P.A.T.N. - national territory development plan

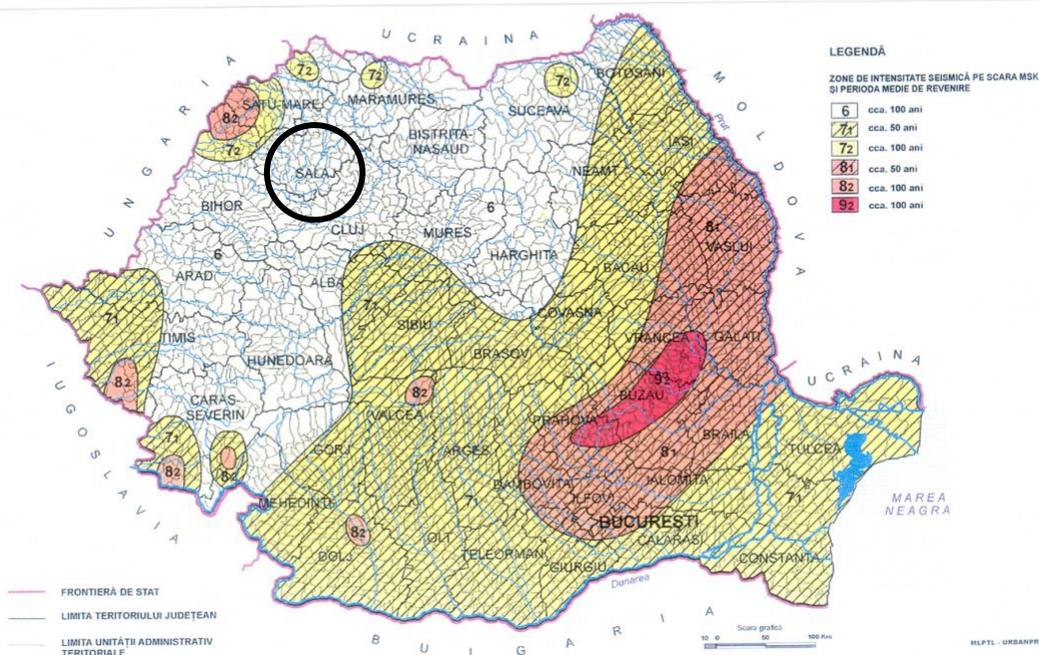
In accordance with LAW no. 575 from 22 October 2001 regarding the approval of the National territory development plan - Section V - Natural risk areas, published in: The Official Journal of Romania no. 726 from 14 November 2001, the areas that present a potential for the occurrence of natural destructive phenomena are analyzed and classified.

Pursuant to the present law, the natural risk areas are the geographically delimited areas, which present a potential of occurrence of natural destructive phenomena that can affect the population, human activities, natural environment and the built environment, and which can make human victims.

A. Earthquakes

In accordance with Addendum no. 1, the studied area falls under the area with Low seismic intensity on the MSK scale with a recovery period of approximately 100 years. (acc. SR 11100/1-92)

C. CUTREMURE DE PAMANT

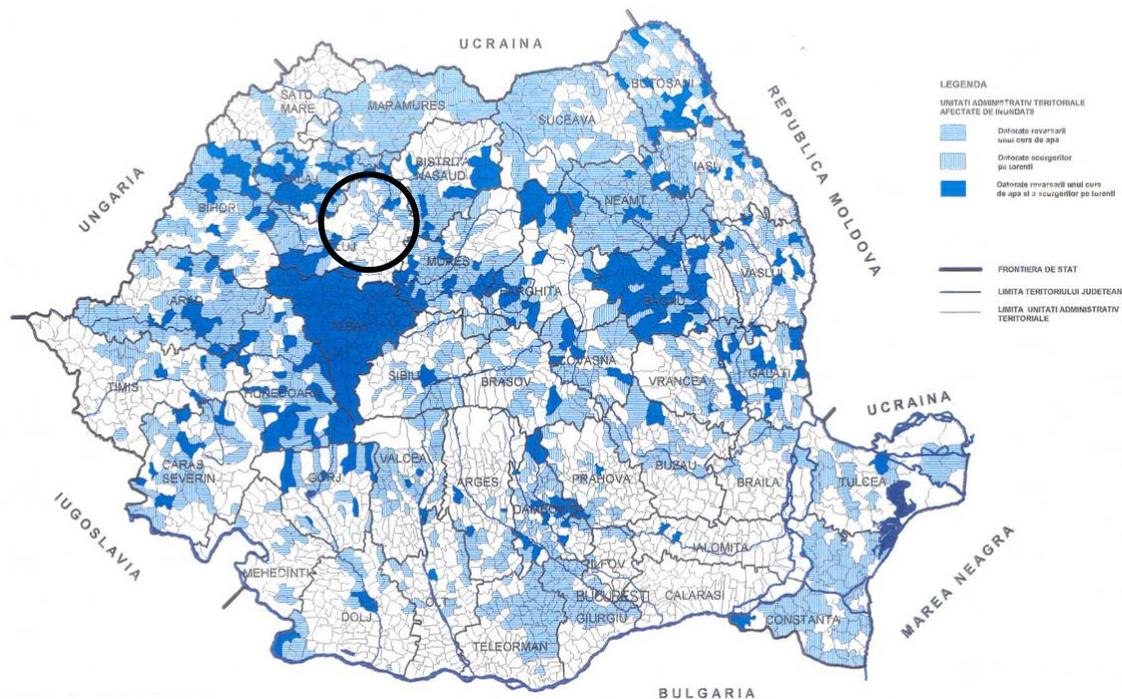


B. Floods:

In accordance with Addendum no. 4a, the area falls under the area with a potential for floods due to a course of water and flows on streams.

PLANUL DE AMENAJARE A TERITORIULUI NATIONAL SECTIUNEA a V-a - ZONE DE RISC NATURAL INUNDATII

Anexa Nr. 4 a

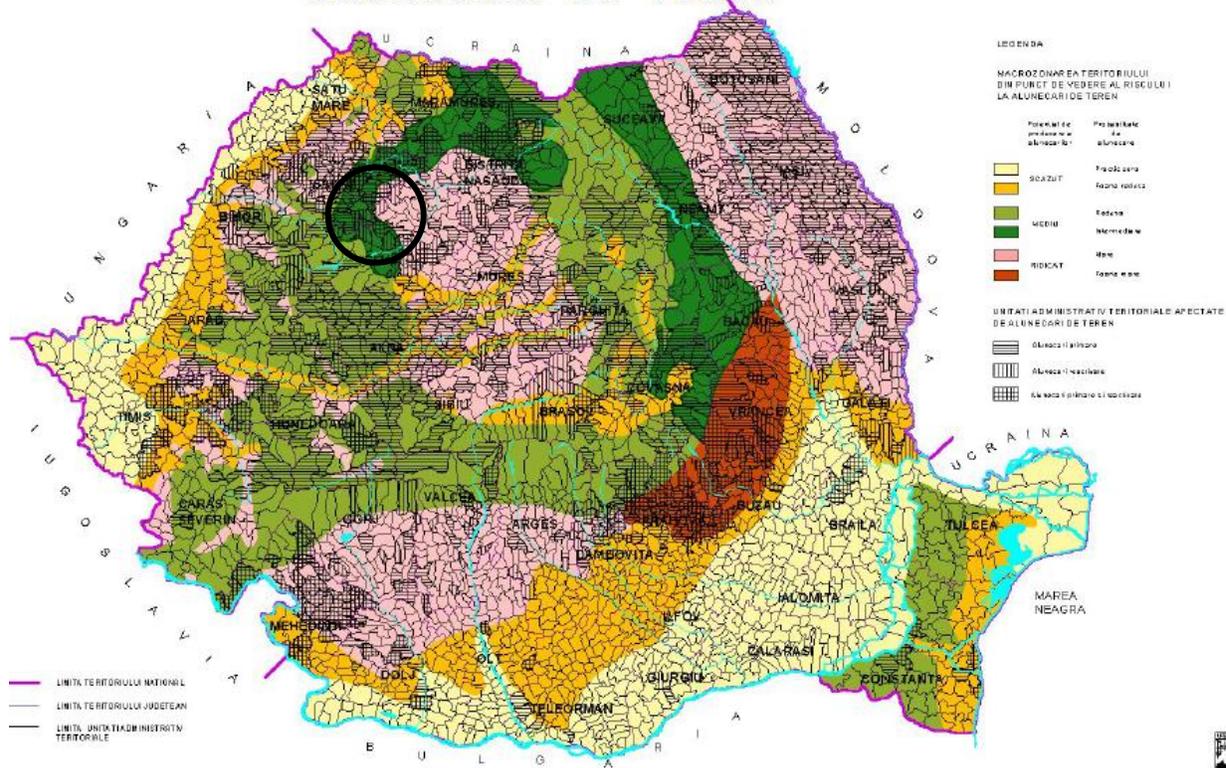


C. Landslides

In accordance with Addendum no. 6, the area falls under the area with a medium-high potential for landslides and medium landslide probability.

PLANUL DE AMENAJARE A TERITORIULUI NATIONAL SECTIUNEA a V-a - ZONE DE RISC NATURAL ALUNECARI DE TEREN

Anexa nr. 6



Geotechnical assessment

1. Final classification in the geotechnical category

As a result of laboratory investigations and testing, it was ascertained that the foundation terrain modifies its preliminary conditions of classification.

Factors to be considered	Description	Score
Terrain conditions	Medium terrains	3
Underground water	With normal dewatering	2
Classification of construction based on importance category	Normal	3
Proximities	No risks	1
Seismic area	Ag = 0.10 g	1
Geotechnical risk	Moderate	10
Geotechnical category	2	

According to the calculated score, the paper definitively falls under the geotechnical category 2, with moderate geotechnical risk. The classification has been made according to the *Normative regarding the geotechnical documentations for constructions* indicative **NP 074 – 2014**

- The classification of lands under the medium terrain category was realized due to the presence of clays and dusts that present free swelling characteristic to active lands, lands with swellings and high contractions (PUCM). That is why, upon design and execution of foundations, the normative 0001-96 - “Design and execution code for construction with foundations on lands with swelling and high contractions” shall be taken into consideration.

2. Foundation laying conditions

Foundation depth > 0.90 m (to the natural terrain elevation).

- The good foundation layer is the dusty sandy, brown, plastic, rich (2) clay layer for F1, sandy brown-gray clay (3) for F2, dusty sandy gray clay (4) for F3 and sandy gravel (3) intercepted on the drilling works' depth.

- Using the conventional calculation pressure for the estimation of the foundation terrain bearing, **the conventional pressure p_{conv} [kPa]** for the dusty sandy, brown, plastic, rich (2) clay layer for F1, sandy brown-gray clay (3) for F2, dusty sandy gray clay (4) for F3 and sandy gravel (3), it was established, in accordance with Addendum B under **STAS 3300/2-85**, for continuous foundations with a base width $B = 1.00$ m, and a foundation level of the systematized terrain level of $D_f = 2.00$ m, as **250 kPa**. The methodological calculation corrections prescribed under **STAS 3300/ 2-85**, item B.2. must be applied for any other foundation base width sizes and other another embedding depth. In order to perform the foundation terrain calculation, upon the limit state of bearing capacity, due consideration shall be paid to the characteristic geotechnical values for the intercepted lands and rendered on the attached drilling sheet.

3. RECOMMENDATIONS și conclusions:

- A continuous foundation or a mat foundation system shall be used;
- The deformities that the terrain may comport must not exceed the accepted limit for the construction type;
 - The foundation must be created in such a way as to be capable of evenly transmitting and allocating, in absolute safety, the effort to which the superstructure part is subjected (the upper construction); the foundation depth must correspond to the norms, that is, the foundation must not be affected by frost, the soil's swelling or contraction, or by its softness.
 - The stagnation of waters on the site and in the foundation digs shall not be allowed; dewatering works shall be considered as to ensure, as much as possible, the dry execution of digs and concrete laying;
 - Special attention shall be paid to the management of rainwaters and of waters pertaining to deterioration of utility grids.
 - The areas that are not covered in concrete shall be covered in grass;
 - A geologist must be present as to draft the protocol regarding the nature of the foundation terrain.

Eng. Ali Ghbech



