GEOTECHNICAL STUDY AND CALCULATION OF THE FOUNDATION LAND FOR THE LOCATION OF RAISING CHICKENS FARM

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Abstract

The geotechnical study resulted from the need to know the foundation land in order to properly place the investment and includes the geotechnical exploration works performed in the site area, with the aim of providing the data necessary to solve the basic problems specifying the aspects related to: the stratification of the land on the site; physical-mechanical characteristics of existing soils; admissible pressures at different foundation levels; probable settlements; framing of field excavations; frost depth; seismic framing; hydrogeological data.

Key words*:* geotechnical study; field geotechnical works; place; warehouse

INTRODUCTION

The present study resulted from the need to know the foundation land in order to locate a zootechnical pig breeding farm. The researched site is located in Bratovoiești, Dolj county. From a morphological point of view, the site is a relatively flat plateau, it is good for foundation, having the stability ensured, the area is part of the Wallachian Platform, the Moesic domain and the ground in the foundation site consists of rocks of Quaternary origin (vegetable soil and sandy yellowish clays , dusty, with gravel at the base from the old terrace).

MATERIALS AND METHODS

The geotechnical study resulted from the need to know the foundation land for the proper location of the investment and includes the geotechnical exploration works carried out in the site area, with the aim of providing the data necessary to solve the basic problems specifying the aspects related to: the stratification of the land on the site; physical-mechanical characteristics of existing soils; admissible pressures at different foundation levels; probable settlements; framing of field excavations according to TS regulations; frost depth; seismic framing; hydrogeological data (Cioboată M et al. 2012).

Two direct surveys were carried out for the research of the foundation land, from which samples were collected and laboratory analyzes were carried out.

The exploration of the land was carried out through: direct observations, geological mapping of the studied area; execution of two direct surveys (S1 and S2) up to 1.50 m depth; performing penetrometric tests at different depths in the area of the foundation pressure bulb, with the lightweight dynamic penetrometer (PDU); collection of disturbed and undisturbed samples and their analysis.

When calculating the foundation land based on conventional pressures, the conditions must be respected (Cioboată M. et al. 2021):

- to centric loads: $P_{ef} < P_{conv}$ şi $P'_{ef} < 1.2\ P_{conv}$
- for loads with eccentricities in one direction: $P_{ef\ max} < 1,2\ P_{conv}$ in the fundamental group; $P'_{ef\ max} < 1,4\ P_{conv}$ in the special group;
- for loads with eccentricities in both directions: $P_{efmax} < 1,4\ P_{conv}$ in the fundamental group; $P'_{ef\ max} < 1,6\ P_{conv}$ in the special group

Conventional pressures are determined by taking into account the basic values Pconv from the tables. The basic values in the tables correspond to the conventional pressures, with the footing width B = 2m and the foundation depth Df=2.0m.

$$P_{conv} = \bar{p}_{conv} + C_B + C_D \text{ , în kPa}$$

Width correction (C_B): $C_B = \bar{p}_{conv} + K_1$ (B - 1) kPa where: K_1 is a coefficient with the value of 0.10 for non-cohesive soils except dusty sands and 0.05 for dusty sands and cohesive soils.

For B > 0.5 m we have: $C_B = 0,4\ \bar{p}_{conv}$ in non-cohesive soils with the exception of dusty sands and $C_B = 0,2\ \bar{p}_{conv}$ to dusty sands and cohesive soils.

Depth correction (CD): $C_D = \bar{p}\ [(D_f\text{-}2)/4]$ kPa for Df < 2,0 m and $C_D = K_2\ \bar{\gamma}\ (D_f - 2)$ kPa for Df > 2,0 m; where: Df=foundation depth in meters; K_2=coefficient with various values (2.5 for non-cohesive soil except dusty sands; 2.0 for dusty sands and cohesive soils with low and medium plasticity; 1.5 for cohesive soils with high and very high plasticity); $\bar{\gamma}$ = the calculation volumetric weight of the layers located above the base of the foundation, calculated as a weighted average with the thickness of the layers, kPa/m^3. Conventional calculation pressures are centralized in table 2, for foundation depths (Df = 1.10; 1.20; 1.50) and foundation widths (B = 0.5; 0.8; 1.0).

RESULTS AND DISCUSSIONS

The researched site is located in the outskirts of Desa, Dolj county. From a morphological point of view, the location is a relatively flat plateau, it is good for foundation, having the stability ensured, the area is part of the Wallachian Platform, the Moesic domain. Two direct surveys (S1 and S2) were carried out up to 1.50 m deep. The surface mapping of the area combined with the results obtained from the analysis of the data from the direct surveys carried out, indicates a land of pelitic clay formation.

In the S1 survey, the following stratification was identified: 0.00-0.60 m blackish sandy-clay fill; 0.60-1.80 m brown dusty clay, consistent plastic, medium compressibility and low moisture; 1.80-3.00 m medium yellowish clayey sands, consistent plastic, medium compressibility, moist; 3.00-6.00 m gravel and sand from the old terrace; hydrostatic level intercepted at 6.0 m depth without direct influence of the foundation elevation.

In the S2 survey, the following stratification was identified: 0.00-0.0.60 m blackish sandy-clay fill; 0.60-1.70 m brown dusty clay, consistent plastic, medium compressibility and low moisture; 1.70-3.00 m medium yellowish clayey sands, consistent plastic, medium compressibility, moist; 3.00-6.00 m gravel and sand from the old terrace. The average geotechnical parameters of the surface layer consisting of yellowish dusty-sandy clays are:

- natural humidity (W%): 23.30 %
- volumetric weight at natural humidity: 18.60 KN/m^3
- porosity (n): 42,65%
- pore index (e): 0,74
- plasticity index (Ip): 18,70
- degree of saturation (S_r): 0,79
- the angle of internal friction: (Ø): $15,60^0$
- cohesion (c): 25,00 kPa

The average geotechnical parameters of the layer of gravel with boulders in sand-clay matrix are:

- natural humidity (W%): 7,23 %
- volumetric weight at natural humidity: 21,00 KN/m^3
- the angle of internal friction: (Ø): 30^0

The classification of the land for excavation is established according to the mode of behavior during digging, thus for the soil formation identified on the site studied, the land has a semi-tart behavior for manual digging and respectively class III for mechanical digging. The geotechnical category of the location land is 1 and the degree of geotechnical risk is low, they are established taking into account the ground conditions:

- good land for a foundation (clays, dusty sands covered by vegetation): 2 points
- underground water (normal depletion): 1 point
- construction importance category (normal): 2 points
- neighborhoods (without risks): 1 point
- seismicity of the area (seismic zone D): 2 points

The foundation conditions result from the correlation of the data of the geotechnical research carried out on the foundation land with the reference data of the area, it is found:

- the land is flat and stable;
- the underground water level is intercepted at over 6.20 m from the natural ground level, the water having intense carbonic and very weak magnesium aggressiveness towards concrete;
- continuous foundations under the walls at -1.10 m maximum depth are recommended;
- the peak value of ground acceleration at seismic design ag is 0.15 g for IMR of 225 years and 20% probability of exceedance in 50 years;
- the corner period of the response spectrum (Tc) is 0.75 s;
- the snow load on the ground (Sk) is 2.0 KN/m2;
- the maximum frost depth is - 0.80 m;
- the basic value of the conventional calculation pressure for the foundation land is 300 kPa. The calculation results are centralized in table 1 for conventional calculation pressures (P_{conv}).

Table 1. Table with conventional design pressures (P_{conv}) for different foundation depths and foundation widths (kPa)

Survey	Foundation depth (m)	Conventional design pressures for different widths B (m)			Soil nature
		0.5	0.8	1.0	
S1 S2	1.10	225.00	229.50	232.50	0.00-0.60 m blackish sandy-clay fill; 0.60-1.80 m brown dusty clay, consistent plastic, medium compressibility and low moisture; 1.80-3.00 m medium yellowish clayey sands, consistent plastic, medium compressibility, moist; 3.00-6.00 m gravel and sand from the old terrace
	1.20	232.50	237.50	240.00	
	1.50	255.00	259.50	262.50	

CONCLUSIONS AND RECOMMENDATIONS

As a result of the field research and the analyzes carried out, it follows:

- from a morphological point of view, the site is relatively flat and stable;
- the foundation land is formed by a lithological succession composed of: sand-clay fill of blackish color; brown dusty clay, consistent plastic, medium compressibility and low moisture; medium yellowish clayey sands, consistent plastic, medium compressibility, moist; gravel and sand from the old terrace;
- the geotechnical surveys carried out intercepted the aquifer horizon, the phreatic water level being over 6.20 m;
- the maximum freezing depth is - 0.80 m;
- from the point of view of seismicity, the researched surface is in seismicity zone D, having ag = 0.15, corner period Tc = 0.75 s;
- the snow load on the ground (Sk) is 2.0 KN/m^2;
- the last 15 cm of the excavation will be done manually on the day of pouring the leveling concrete under the foundations;
- the studied location is part of first geotechnical category and has a low geotechnical risk;
- the conventional pressures vary between P_{conv} = 225.00 kPa, for the foundation depth Df = 1.10 m and the foundation width B = 0.50 m and Pconv = 262.50 kPa for Df = 1.5 m and B = 1.0 m (table 1).

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