LIVESTOCK FARM LOCATION OF PIGS REPRODUCTION BASED ON THE GEOTECHNICAL STUDY

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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 location is located in Desa township, 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 and the geological assemblage of the area includes formations of Neogene and Quaternary age (the Neogene formations were not intercepted with geotechnical research works).

MATERIALS AND METHODS

The present 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 (Cioboata M.N. 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.

$P_{conv} = \bar{p}_{conv} + C_B + C_D$, 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 = 0.8; 1.0; 1.5) 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 survey S1, the following stratification was identified: 0.00-0.10 m clayey topsoil; 0.10-0.70 m brown dusty sands; 0.70-1.50 m brown sandy dust.

In survey S2, the following stratification was identified: 0.00-0.10 m clayey topsoil; 0.10-0.70 m brown dusty sands; 0.70-1.50 m brown sandy dust.

The geotechnical characteristics of the soils identified in the two surveys are presented in table 1.

The classification of the land for excavation is established according to the way of behavior during digging, thus for the clayey pelitic formation identified on the studied site, the land has a semi-terrain behavior for manual excavation and class III for mechanical excavation respectively.

The geotechnical category of the location land was established taking into account the land conditions (dusty sands, clayey dusts, medium and weak foundation soils: 3 points), underground water (normal depletions: 2 points), the construction importance category (normal: 3 points), the neighborhoods (no risk: 1 point) and the seismicity of the area (seismic zone E: 1 point), obtaining a score of 10 points according to which the geotechnical risk is

classified as geotechnical category 2 (moderate geotechnical risk category).

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

- the terrain is flat and stable
- the underground water level is intercepted at approx. 1.20 m from the level of the natural terrain, the water having intense carbonic and very weak magnesium aggressiveness towards concrete
- peak seismic design ground acceleration ag is 0.15 g for 225-year IMR and 20% probability of exceedance in 50 years
- the corner period of the response spectrum (Tc) is 1.0 s
- the snow load on the ground (Sk) is 2.0 KN/m^2
- the maximum frost depth is - 0.80 m
- the basic value of the conventional design pressure for the foundation soil is 250 kPa.

The calculation results are centralized in table 2 for the conventional calculation pressures (Pconv).

*Table 1.*The physical-mechanical characteristics of the land (the nature of the land)

Characteristics of surveys	Soil layers description		
Survey S1	Clay soil	Brown dusty sands	Brown sandy dust
Depth (m)	0.00-0.10	0.10-0.70	0.70-1.50
Groundwater level	-	-	0.80-1.20
Granulometry	-	-	-
Gravel	-	0	0
Large sand	-	2	1
Medium sand	-	16	5
Fine sand	-	38	10
Dust	-	39	71
Clay	-	5	13
Physical characteristics	-	-	-
Volumetric weight at natural humidity (KN/m^3)	-	18.9	18.7
Volumetric weight (KN/m^3)	-	26.2	26.3
Wa (%)	-	-	30.1
Wp (%)	-	-	11.2
Ip (%)	-	-	18.9
W (%)	-	18.5	21.0
Sr	-	0.76	0.85
n (%)	-	39	39
E	-	0.64	0.65

Characteristics of surveys	Soil layers description		
Survey S1	Clay soil	Brown dusty sands	Brown sandy dust
Mechanical characteristics	-	-	-
The angle of internal friction ($Ø^0$)	-	39	8
Cohesion (c), KPa	-	9	11
Average compressibility (M_{2-3}) daN/cm^2	-	92	84
Poisson's ratio (μ)	-	0.30	0.30
Settling (cm/m)	-	3.08	3.36
Penetration (hits)	-	-	15
Dynamic penetration (Kpa)	-	-	35
Survey S2	Clay soil	Brown dusty sands	Brown sandy dust
Depth (m)	0.00-0.10	0.10-0.70	0.70-1.50
Groundwater level	-	-	0.80-1.20
Granulometry	-	-	-
Gravel	-	0	1
Large sand	-	2	3
Medium sand	-	17	6
Fine sand	-	38	12
Dust	-	36	68
Clay	-	7	11
Physical characteristics	-	-	-
Volumetric weight at natural humidity (KN/m^3)	-	18.8	18.6
Volumetric weight (KN/m^3)	-	26.3	26.3
Wa (%)	-		
Wp (%)	-		
Ip (%)	-		
W (%)	-	21	23
Sr	-	0.81	0.93
n (%)	-	39	40
E	-	0.65	0.66
Mechanical characteristics	-	-	-
The angle of internal friction ($Ø^0$)	-	18	9
Cohesion (c), KPa	-	9	11

Characteristics of surveys	Soil layers description		
Survey S1	Clay soil	Brown dusty sands	Brown sandy dust
Average compressibility (M_{2-3}) daN/cm^2	-	84	79
Poisson's ratio (μ)	-	0.30	0.30
Settling (cm/m)	-	3.21	3.21
Penetration (hits)	-	13	13
Dynamic penetration (Kpa)	-	30	30

*Table 2.*Table with conventional calculation pressures (P_{conv}) for different foundation depths and foundation widths (kPa)

Survey number	Foundation depth (m)	Conventional design pressures for different widths B (m)			The nature of the terrain
		0.5	0.8	1.0	
S1 S2	0,8	168.75	172.50	175.00	Clay soil; Brown dusty sands; Brown sandy dust
	1.0	181.25	185.00	187.50	
	1.5	212.50	216.25	218.75	

CONCLUSIONS

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 consists of a lithological sequence composed of: clayey soil, brown dusty sands and brown sandy dusts
- the geotechnical surveys carried out intercepted the aquifer horizon, the phreatic water level being approximately 1.20 m
- the maximum depth of frost is - 0.80 m
- from the point of view of seismicity, the investigated surface was in the seismicity zone E, having ag = 0.15, corner period Tc = 1.0 s
- the snow load on the ground (Sk) is 2.0 KN/m^2
- the last 10 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 second geotechnical category and has a moderate geotechnical risk
- the conventional pressures vary between Pconv = 168.75 kPa, for the foundation depth Df = 0.8 m and the foundation width B = 0.50 m and Pconv = 218.75 kPa for Df = 1.5 m and B = 1.0 m (table 2).

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