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Foundation Methods for the Buildings of a Residential Neighbourhood, Placed on Heterogeneous Soils

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Abstract

The paper represents the geotechnical investigations for 2 piles of buildings composed of 6 buildings with B+G+5S and B+G+6S. Following the rules of good practice, a detailed geotechnical study provides information to inform and support final design decisions and construction specification. The boreholes was located on each construction and also was made DP. The solutions for A pile was direct foundation and for D pile indirect foundation, on pillow. The settlements on the final work was very good.

Keywords: *geotechnical investigation, foundation, settlement.*

Introduction

The geotechnical research performed within the said area aimed at establishing the foundation conditions for a complex of 49 buildings with a height range of B+G+5S and B+G+6S.

The site is situated in Chitila commune, on a land that belonged to S.C. Soceram S.A., on which there were initially several buildings with basement and height range of up to 3S.

According to the seismic design code P100/1-2006, for the said area, the peak value of the design land acceleration, ag = 0,24 g and the corner seismic zone of the response spectrum, Tc = 1,6 s.

The frost depth, according to STAS 6054-77 is of 0,90 m.

Considering the provisions of the normative act NP 074-2007, there was performed the preliminary assignment within the geotechnical category 1; after the first drillings, because of the low bearing capacity and because of the presence of the filling material, there was changed the assignment within the geotechnical category 2.

We must specify the fact that each quarter is provided with a common basement that gathers 6 blocks of flats.

Foundation soil investigation

The investigation of the foundation soil was made for each block of flats by performing a drilling and a slight dynamic penetration, both at a 10 m depth. The drillings were performed with a RKS system drilling machine and the penetrations with the PDU slight dynamic penetration machine, according to the normative act C 159-89.

For A quarter the soil stratification intercepted during the drillings shows a heterogeneous filling material of 2-3,30 m width, followed by a silty clays or clayey silts package, here and there with sands or gravel clay galls. From the deformability point of view, they have high compressibility on average, the M_{2-3} deformation module having values from 55,55 to 125,00 daN/cm^2. The PDU penetration results are correlated with the drillings and the data obtained by processing the information resulted from them (n%, e, Ic, Ip, M_{2-3}) show values very close to the laboratory analyses (Table 1).

For D quarter the soil stratification shows a filling material with widths that reach 7 m (fig. 3). The material consists of decayed building materials, garbage and various terigenous materials. Here and there the organic material exceeds 12% and the water was found as from 7m deep. Under it, there is a clayey silts package that go down to the silty sands, with high compressibility on average.

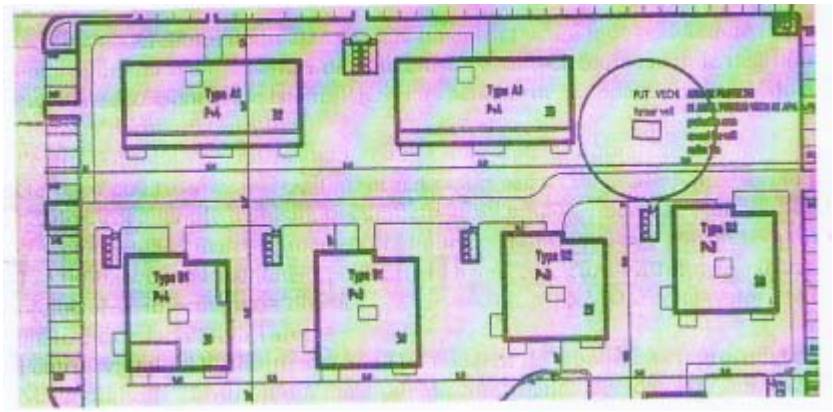


Fig. 1. Buildings' positioning in A quarter

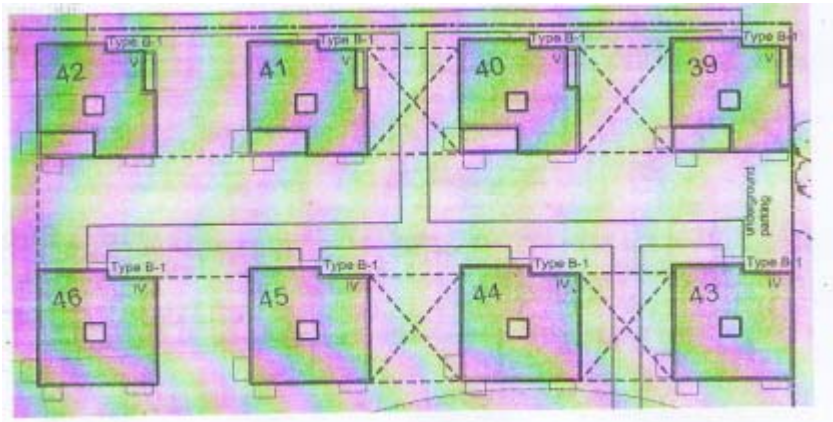


Fig. 2. Buildings' positioning in D quarter

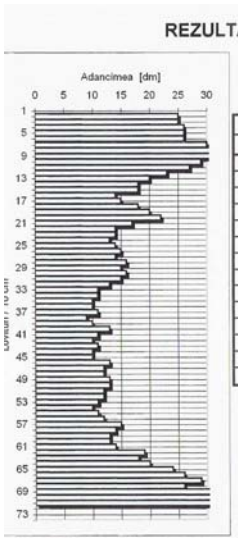
Recommended foundation solutions

For A quarter, the basement depth being designed to -3,70 m, there was adopted the solution of the direct foundation. From the settlings' calculation there resulted values high enough, of 3-8 cm. In this case, there was recommended the solution to improve the foundation soil quality by tamping by means of a 24t vibrating tamper, with 20 double passes.

At the end of the operation, there were performed tamping tests by means of the Proctor modified method.

For D quarter, the solution agreed by the beneficiary was to perform a 3,30 m wide pillow. Although there were also made calculations for indirect foundations on piles, this solution was not accepted by the beneficiary.

The pillows building was conceived in such manner as to takeover well the buildings' pressures, but also to prevent the water's capillary ascent. By means of the job specification delivered by the geotechnician it was designed based on a plus material layer of 0,60 cm thickness, followed by alternative crushed stone and silty clay layers, of 0,20 m thickness, tamped. For each layer there were performed tamping determinations by means of the Lucas plate.



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PDU 2

H	N10	Rd	Rp	n	e	Ic	I_D	M_{2-3}	E	F
m	lov/10cm	daN/cm²	daN/cm²	%	-	-	-	daN/cm²	daN/cm²	°
0,0-0,5	25.6	82.05	61.54	41.4	0.71	1.04	0.58	95.34	162.08	33.80
0,5-1,0	32.4	101.79	76.34	40.3	0.67	1.19	0.66	99.27	168.77	34.03
1,0-1,5	18.6	52.54	39.41	43.7	0.78	0.88	0.48	87.21	130.82	34.25
1,5-2,0	18.4	50.96	38.22	43.9	0.78	0.88	0.48	86.66	129.99	34.45
2,0-2,5	14.0	35.35	26.52	45.6	0.84	0.78	0.41	79.99	87.99	34.65
2,5-3,0	15.2	37.66	28.24	45.3	0.83	0.81	0.43	81.14	105.48	34.83
3,0-3,5	11.0	25.11	18.84	47.2	0.89	0.72	0.36	73.75	81.13	35.01
3,5-4,0	10.8	24.22	18.16	47.3	0.90	0.71	0.36	73.09	80.40	35.19
4,0-4,5	10.8	22.50	16.88	47.6	0.91	0.71	0.36	71.75	78.92	35.35
4,5-5,0	12.4	25.43	19.07	47.1	0.89	0.75	0.39	73.98	81.38	35.51
5,0-5,5	11.2	21.46	16.09	47.8	0.92	0.72	0.36	70.88	77.97	35.66
5,5-6,0	13.8	26.04	19.53	47.0	0.89	0.78	0.41	74;41	81.85	35.81
6,0-6,5	21.4	37.94	28.46	45.3	0.83	0.95	0.52	81.28	105.66	35.95
6,5-7,0	63.0	58.51	43.88	43.2	0.76	1.00	0.95	89.18	133.77	36.09

PAMANT COEZIV

Data: DECEMBRIE 2005

Întocmit: M.Vlasceanu

Table 1. Interpretation of the PDU data

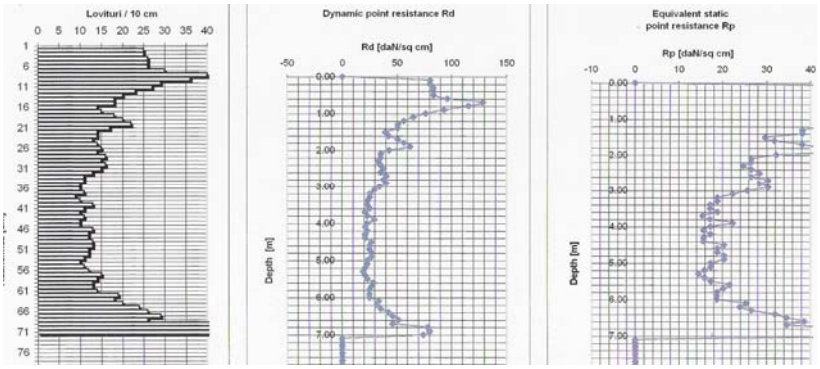

Table. 2 Interpretation of the PDU data

Results

The settling follow-up during the building works showed remarkable results. For A quarter, the total settlings measured after the flats' putting into operation, were of 7-16 mm.

For D quarter, at the end of the building works, the settling was of 11 mm.

These results show that the foundation on very thick pillows, although it is generally avoided by the geotechnical designers, when it is well designed and performed, can have good results, on the terms of a good economic efficiency.

Fig. 3. Filing material in D quarter

References

1. The normative act regarding the technical documentations for buildings, NP 074-2007 indicator
2. Technical instructions regarding the foundation soil by means of cone penetration, static penetration, dynamic penetration, vibropenetration, C 159-89 indicator
3. Geologic Don s.r.l. "Geotechnical study regarding the buildings' site for the Banatului Park – Chitila", 2007

Modalități de fundare pentru clădirile unui cartier rezidențial, dispus pe terenuri eterogene

Rezumat

Se prezintă două moduri de fundare, directă şi pe pernă, într-o zonă unde grosimea materialului de umplutură atinge valori de până la 7m. Pernele au fost concepute diferit, funcție de adâncimea şi consistența materialului pe care au fost dispuse.