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COMPARISON OF THE NUMERICAL ANALYSIS RESULTS AND THE GEOTECHNICAL MONITORING RESULTS OF THE PUMP STATION IN JASLOVSKÉ BOHUNICE

ZHODNOTENIE VÝSLEDKOV NUMERICKEJ ANALÝZY A GEOTECHNICKÉHO MONITORINGU OBJEKTU ČERPACEJ STANICE V JASLOVSKÝCH BOHUNICIACH

Abstract

This paper deals with numerical analysis and experimental measuring of settlement of the pump-station in Jaslovské Bohunice. The obtained results are compared and evaluated. Analyzed pump-station is a technologically complicated building structure founded on loess. Design and realization of complex geotechnical monitoring is presented. Verification of reliability of the particular pump-station structures is made. Conclusions and recommendations for practical realization are mentioned.

Abstrakt

Príspevok sa zaoberá numerickou analýzou a experimentálnym vyšetrovaním procesu sadania čerpacej stanice v Jaslovských Bohuniciach. Získané riešenia sú vyhodnotené a následne vzájomne porovnávané. Riešená čerpacia stanica predstavuje technologicky komplikovanú stavbu, ktorá je založená na sprašiach. V príspevku sa zaoberáme návrhom a realizáciou komplexného geotechnického monitoringu. Je overovaná aj spoľahlivosť jednotlivých objektov čerpacej stanice. Príspevok je doplnený záverom a odporučeniami pre praktickú realizáciu.

1 INTRODUCTION

According to the project of a stepwise reconstruction of the 1st and 2nd block of Nuclear Power Plant V – 1 (JE V – 1) in Jaslovské Bohunice, in the first phase the buildings of pump-stations SO 585a, 585b and cooling towers SO 580a, 580b (Fig. 1) were build-up.

Mentioned buildings are very important from the production and reliability operation point of view. These structures are founded on the loesses and therefore they are sensitive for the overall and non-uniform settlement. From this reason the complex project considering the settlement effects and monitoring of the individual building structures were made.

2 STRUCTURAL AND TECHNICAL SOLUTION OF THE PUMP-STATION BUILDINGS

The set of pump-station buildings consists from two separate pump-stations (SO 585a, SO 585b) and two cooling towers (SO 580a, SO 580b). The group of buildings is founded in a common foundation pit of irregular rectangle shape with ground plan dimensions 48.3 x 33.5 m protected by

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anchored sheeting wall (Fig. 1). The pump-station structures are three-storey buildings rested on the reinforced concrete plates with dimensions of 16.8 x 18.8 m and thickness of 0.8 m. The foundation gap with respect to the level of natural terrain (±0.000m) is located on level -9.0 m. Load-bearing structural system up to terrain level is a wall structure and in upper part it is a skeleton-wall combined system. Vertical and horizontal load-bearing structures up to level of terrain represent a monolithic system. Overall height of the structure is 10.1 m.

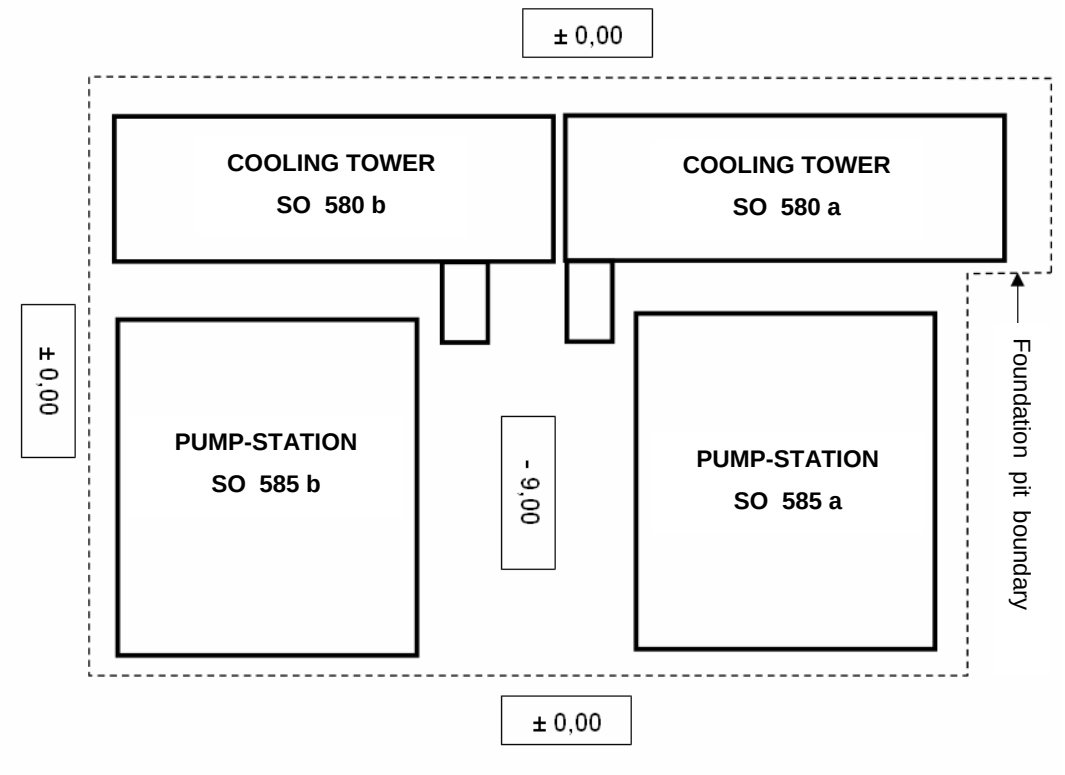

Fig. 1 Section plan of pump-stations and cooling-towers in foundation pit

3 ENGINEERING-GEOLOGICAL CONDITIONS OF BUILDING SITE

For assessment of the engineering and geological conditions of building site and properties of subsoil, detailed geotechnical investigation were realized. Important physical parameters, indexes, strength and deformations properties of the subsoil were determined and the laboratory experiments were made. The obtained results of the geotechnical investigation according to STN 73 1001 code are given in Tab.1. The ground water level was identified in depth of 21.0 m

Tab. 1 Pump-station subsoil classification

Layer	Type of soil	Classification (STN 73 1001)		Depth / m /	Thickness / m /
		Type	Symbol		
1.	Backfill	F6	CIY	0,0 - 3,0	3,0
2.	Clay with middle plasticity (loess)	F6	CI	3,0 - 14,3	11,3
3.	Clay with high plasticity	F8	CH	14,3 - 17,0	2,7
4.	Gravel well grained	G1	GW	17,0 - 39,5	22,5
5.	Clay (neogen)	F8	CH, CV	> 39,5	-

4 ANALYSIS OF THE NUMERICAL RESULTS AND MONITORING

Results of the overall settlement and geotechnical monitoring data are cited in [1, 2]. For the analysis of vertical displacements of pump-station buildings SO 585a and SO 585b characteristic longitudinal and transversal profiles (Fig. 2) were selected.

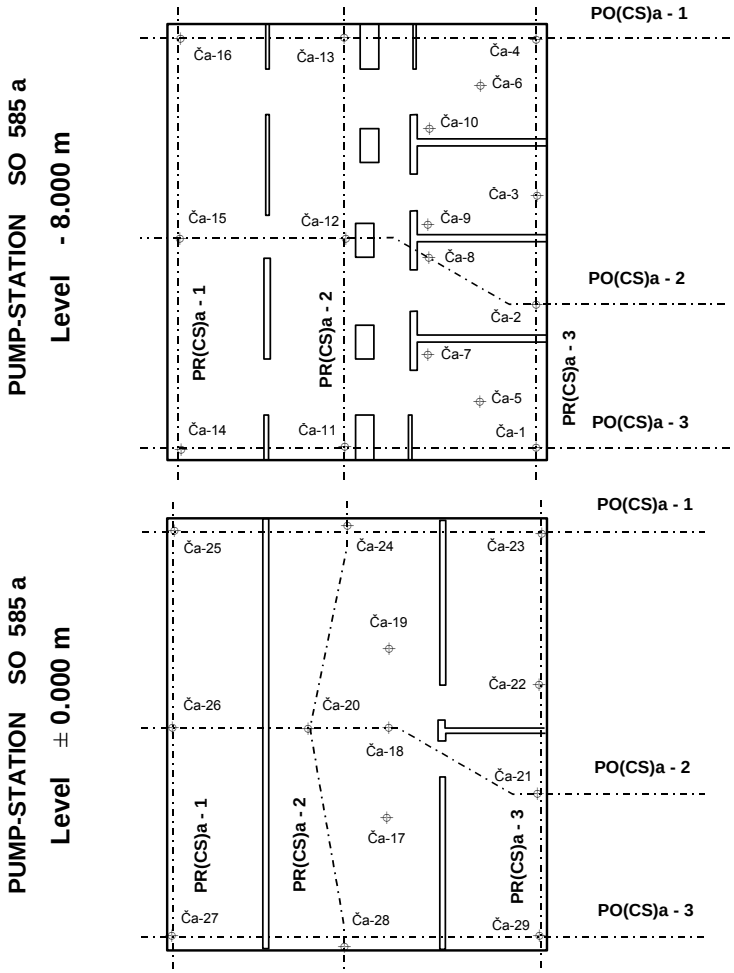

Fig. 2 Scheme of the measuring points positions of the longitudinal and transversal profiles in pump-station building SO 585a (on the level -8.000m and ±0.000m)

Displacements of measuring marks were evaluated as relative values of deformations with respect to the basic measuring realized after their stabilization. From the obtained results of vertical displacements it is possible to suppose, that load-bearing structural system of pump-station structures from the deformation point of view behaves as a solid body. Obtained measured values are markedly less than assumed ones. The measured values reach 12.5% of assumed values. The differences between calculation results and measured data are caused by following factors:

- in the subsoil of building structures significant consolidation processes occur (obtained results of vertical settlements from May 2000 can not be regarded to be final),
- the measured values are affected by interruption of continuous measuring process (transfer of marks). Considering the time-trend of vertical displacements one can assume that values of settlement should be higher by approx. 3.0 - 6.0mm.
- in the settlement assumptions with active depth of subsoil 41.0m was considered.
- the subsoil of building structures was loaded by considerable additional load of 180.0kN/m^2 (backfill) later, during following control measuring. Dead load and live long-time load of the structure represent the value 140.0 – 160.0kN/m^2, i.e. 77.0% – 88.0% of backfill loading.

On the basis of comparison of measured and theoretical results it is possible to expect considerable consolidation processes in subsoil of the analyzed objects.

5 CONCLUSIONS

The monitoring of settlement of the building structures was carried out in order to confirm their safety and reliability. Obtained results provide information about the state of building structures as well as a control of theoretical results. Comparison of results (measured and assumed values) is very important from the point of view of reliability of building structures.

The problems concerning the assumed real behavior of building structures are very complicated branch of the geotechnical engineering. It is well-known that consolidation processes are time-depended and continue for several years (but sometimes even dozens of years). The goal of presented geotechnical monitoring was watching, verification and confrontation of the assumed parameters with real values obtained ”in situ”. Correct interpretation of measured data is a very important step of the solution, too.

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