

A GEOTECHNICAL INVESTIGATION FOR AN OFFICE BUILDING IN THE FOOTHILLS OF THE BOHEMIAN FOREST

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ABSTRACT. An office building with a partial basement on an undeveloped plot within Polná na Šumavě was proposed. The municipality is located on the border of Boletice Military Training Area which had some specific security measures that had to be respected during the investigation. The detailed geotechnical investigation describes the geological conditions of the area, points out several complications that can be expected and finally proposes solutions to mitigate them.

KEYWORDS: Geotechnical investigation, military training area, geophysical study, soil stabilization.

1. INTRODUCTION

In the first half of 2024 the INSET s.r.o. company carried out a detailed geotechnical investigation for a new office building in Polná na Šumavě [1]. The project assumes the construction of an office building with a partial basement on an undeveloped plot within the municipality, located close to military grounds (see Figure 1).

The municipality of Polná na Šumavě is located on the border of Boletice Military Training Area, from which it was removed in 2016. In this regard specific security measures had to be followed during the investigation. Some of the project data were classified as secret. A limiting factor during fieldwork was the presence of the military training area itself, where a special permit is required for entry. During investigation some findings were made that under normal circumstances could have been verified with field reconnaissance. With no possibility to enter the military training area maps only had to be used.

Multiple geological units appear in the surroundings of Polná na Šumavě. The bedrock is composed of biotite-sillimanite paragneiss, penetrated by microgranite dykes, both belonging to the Moldanubian Zone. Granulite layers, although indicated by the geological map, were not encountered during investigation. Quaternary sediments can reach up to 15 m of thickness. Two naturally occurring series of fluvial sediments (with differing genetic and geotechnical parameters) are mostly covered with anthropogenic deposits. The whole area was formerly affected by tectonic activity.

Hydrological and hydrogeological conditions are not trivial. A pond that is fed by an unnamed brook, coming from the military training area, is located close to the plot of interest. Outlet from the pond is culverted and led under the plot into the nearby

Polečnice river. Groundwater level oscillates between 0.6 and 2.0 m below surface level.

2. PURPOSE AND GOAL OF THE INVESTIGATION

The main goal of the investigation was to complete the knowledge of ground conditions regarding the proposed office building. According to desk study no boreholes were previously made on the site; the majority of older surrounding boreholes did not reach the bedrock [2, 3]. A basic hydrogeological evaluation was also made. The results of laboratory tests of soils and rocks were used for comprehensive description of ground parameters. At the same time complications that are to be expected during construction works were defined including suggestions to mitigate them.

3. GEOTECHNICAL INVESTIGATION

Positions of all boreholes were determined using a high-precision GNSS receiver. 6 boreholes were realized (maximum depth up to 15 m) with a total length over 60 m; two of them were temporarily cased for aquifer tests. Soil, rock and groundwater samples for subsequent laboratory tests were extracted from the boreholes. Two methods of geophysical survey – soil corrosivity determination and radon index assessment – were implemented.

3.1. CORE DRILLING AND SAMPLING

In the sedimentary layers drilling was realized without drilling fluid, utilizing a tungsten carbide drill bit with a single tube core barrel.

Two of the boreholes reached the bedrock. After overcoming sedimentary layers boring continued up to the final depth using a diamond encrusted drill



FIGURE 1. Site plan of the area of interest including a car park.

bit and a double tube core barrel, utilizing water as drilling fluid (Figure 2).

For determination of their physical and mechanical properties by means of laboratory tests, soil and rock samples were extracted from the boreholes. When boring finished, samples for assessment of groundwater aggressiveness towards concrete and steel were also collected.

3.2. FIELD TESTS

Two of the boreholes were cased temporarily (without filter pack). In these boreholes aquifer tests – short-term pumping and recovery tests – were performed.

Two types of measurements were implemented for determination of soil corrosivity – a ground electrical resistance survey and a stray voltage measurement.

Within the radon index assessment soil gas permeability was defined initially. Subsequently radon concentration was measured.

4. RESULTS OF THE GEOTECHNICAL INVESTIGATION

According to EN 1997-1 (2006) the plot can be classified into the Geotechnical Category 2 mainly because the foundation level is located below the water table.

The plot is covered with anthropogenic deposits that can be generally described as sandy silts, composed of local fluvial sediments mixed with construction waste and fragments of gneiss. The ratio of these materials as well as fines is highly variable which implies

a high degree of heterogeneity in ground conditions. In this layer the foundation of the parts of the building without a basement will take place.

A layer of brook sediments is located below anthropogenic deposits. These sediments are represented mainly as greyish sandy clays. Their grey colour is caused by partially decomposed vegetable matter admixture that was washed off bogs located to the north of Polná na Šumavě. In this layer the foundation of the parts of the building with a basement will occur.

Underneath, Polečnice river sediments are deposited. They are formed of reddish silty sands with no organic matter. The basement rocks are located beneath all sedimentary layers; no foundation works are expected to take place in both these strata.

5. SELECTED NOTEWORTHY GEOTECHNICAL ASPECTS

It is essential to highlight certain aspects that, if neglected, could have adverse effects on subsequent works.

When rough grading is finished, dewatering of the whole area will be vital, typically by sump pumping. The pumping will be necessary until all construction works are finished.

Continuous presence of a certified geotechnician on site during construction works will be crucial as well. This professional will assess the quality of individual foundation levels, mainly from the perspective



FIGURE 2. Drilling rig on site.

of ground conditions heterogeneity but also for potential occurrence of partially decomposed vegetable matter. Subsequently remediation measures can be introduced.

As a solution mechanical soil stabilization was proposed. Initially, aggregate with a controlled particle size distribution will be forced into the ground aiming to homogenise the foundation level. This layer will be protected by a suitable geotextile. Secondly, a compacted aggregate base layer will be constructed.

6. CONCLUSION

The detailed geotechnical investigation for an office building with a partial basement in the municipality of Polná na Šumavě described the geological environment of the area. The design of the building presumes different foundation levels, and thus foundation works on different ground types will take place. Heterogeneous sedimentary layers with potential occurrence of partially decomposed vegetable matter were docu-

mented, with a high water table also present. Dewatering of the area, continuous presence of a certified geotechnician and mechanical stabilization of soil were proposed as mitigation for these factors.

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