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Examples of the construction of deep excavation ditches in weak soils

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Abstract

The information about the engineering- geological conditions in the central part of St Petersburg, which are characterized by deep thickness of weak water saturated soil, is given. The examples of underground space in three constructed buildings in St. Petersburg are considered. The depth of each considered space exceeded 12 m and that required the usage of modern and nonstandard construction and technological methods for protection of the ditch walls. The wall protection were done by sheet piles, by "Wall in ground" method, and "jet grouting", the soil excavation was carried out by traditional method or "Top –down" method.

The basic constructive schemes and technological methods of excavating ditches, test results of deformation of the protection walls during excavation of the ditch and the settlements of the neighboring buildings are given.

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Keywords: weak soils, deep excavation, wall in ground, jet grouting, top-down method

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1. Introduction

The development of the modern City is not possible without the development of underground space. But the construction conditions in St. Petersburg are much more complicated than in any other region of the country. Mainly this is explained by specific geological conditions – the central part of the City is located on weak , watersaturated tixotropic soil, which change their properties depending on the effect of different forces – natural and technogenic. Most of the buildings which were constructed in 18-19 centuries or beginning and middle of 20 th century have cracks and damages of the bearing structures and require the reinforcement of their base and foundations [1].

Any additional settlement of such buildings during ditch excavation by traditional method (pile sheet wall, soil excavation, lowering of ground waters by open excavation and etc) may cause unpredictable result.

The construction in St. Petersburg require high professionalism starting in projecting work when you choose the method of supporting the wall the ditch and the technology of the future work . The availability of the modern equipment for underground work and qualified personnel is of great importance.

The examples of the modern construction in St.Petersburg of three buildings with big underground space are given in the present article.

2. Parking with five underground levels on *Komendantskaya* square

In 2006 the company "GEOIZOL" made the project and started construction of the circular 5 level underground parking on Komendantskaya Square. The depth reached 19,5 m and the diameter 78 m. The general cross section is shown in Fig. 1.

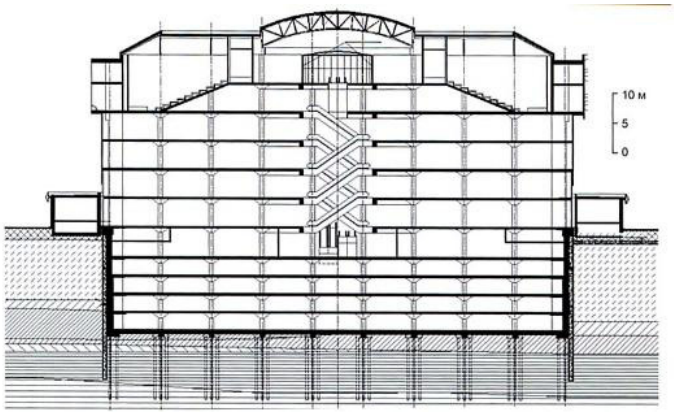

Fig.1. The general cross section of the building.

The main problems which appeared during the construction were the absence of the experience in the construction of such types of buildings in St. Petersburg and complicated geological conditions (thixotropic soil in the upper part of the geological section, high level of ground waters and presence of big boulders).

Since the parking with such spacious underground room was constructed in newly developing region it was possible to dispose it at the distance of 100 m from the nearest buildings. This allowed to neglect the effect of the parking on neighboring buildings.

The technical solution of the erection of the underground part of the building suggested:

1. Initial trench made by "wall in ground" method 24 m deep and 0,8 m wide which was filled cement-clay solution (Fig. 2a) The ground was excavated part by part 3,3 m long each.

2. Immersion of the metal semircircular sheet pile into the trench and its later concreting (Fig. 2b). Sheet pile served as a reinforcement element and additional seal.