



15th International scientific conference “Underground Urbanisation as a Prerequisite for Sustainable Development”

Some geotechnical characteristics of the subway construction in Sofia city, Bulgaria

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Abstract

Sofia subway is already in operation for 18 years although its network expansion continues. At the bottom of its development lay the accumulated experiences from the cities like Moscow, St. Petersburg, Paris, Vienna, Berlin and others.

Sofia is a city with more than 2000 years of history; with several archaeological layers and diverse geological and tectonic conditions. All these characteristics are a prerequisite for complex technical solutions and many challenges to the engineers when they meet unexpected surprises in the geological profiles or underground infrastructure.

The report will present to your attention four situations where along the tunnels route there were unexpected faults or water from the water sewerage network appearing. The above is accomplished with description of the technological solutions to such situations and applied modern geophysical surveys for rapid diagnosis of failures.

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1. Introduction

Sofia metropolitan is already in operation for 18 years although its network expansion continues. The accumulated knowledge from cities like Moscow, St. Petersburg, Paris, Vienna, Berlin and others is the main generator for its development. Sofia metropolitan is much smaller than the mentioned European examples, it doesn't

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have their rich history of construction and operation, but it has its own peculiarities (Fig.1). One of the essential features from geotechnical perspective is that its route passes through many diverse geological and tectonic formations in an area with high seismicity, which is not typical for those cities at all.

The above is a prerequisite for complex technical solutions and many challenges to engineers when they meet unexpected surprises in the geological profiles or underground infrastructure. The construction of Sofia metropolitan in the downtown is done at the beginning of XXI century and this fact predetermines a number of difficulties in protecting the truly rich architectural and archaeological heritage.

The report will present to your attention three situations where along the tunnels route there were unexpected faults or water from the water sewerage network appearing. The above is accomplished with description of the technological solutions to such situations and applied modern geophysical surveys for rapid diagnosis of failures.

2. Geological and urbanity specifics of Sofia

2.1. Specific geological profiles – the main types

The general geological characteristic of the city of Sofia is a kettle with great depth of rock mass – around 400m of the depth. This kettle is filled up with Pliocene clay and Quaternary sand, gravel, sandy clay, soft clay etc. There are also two main ground water levels. The upper water level is not deep, but the Quaternary geological profile is very motley and consists of a thick 10 , 15m layers of soft sandy clays [1]. There are some active faults. Seismic acceleration for the city of Sofia is 0.23g with 475 years of probability and magnitude of $M=7.0$. According to Eurocode 8 soil to a depth of 30m is responding to the C group.

2.1.1. Structure, architecture and urbanity specifics

The geological and tectonic formations of the city are covered with deep layers of archeological artefacts in the very downtown. The construction of the modern city began at the end of XIXth century with narrow streets and pavement, which still create a problem to civil and transport building nowadays. The oldest buildings are masonries, with timber beams and floors or brick arch. As of 1930 the buildings have been made by the help of reinforced concrete. They have deep basements of 3m to 7m. In addition, the underground cavern structures affect their stability.

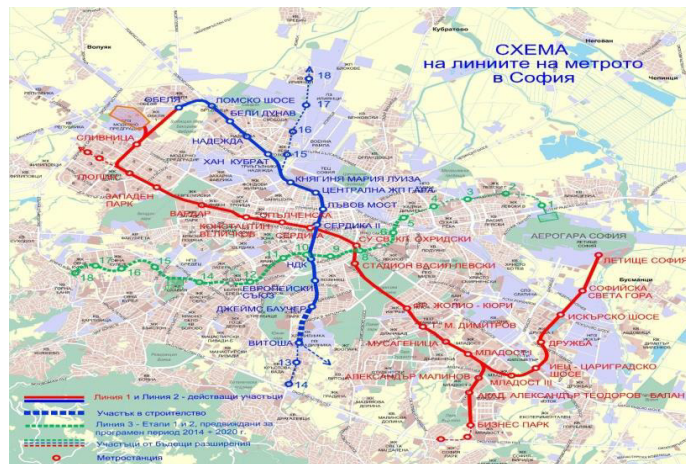


Fig. 1. Sofia metro – General plan [1].

2.2. Metropolitan construction specifics

The Heading Shield technology is specific for Sofia metropolitan construction under the downtown of the city,

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