Study of Integrated Geophysical and Geological Research Methods on Mapping Weakness Structures in Bedrock at Urban Areas

Introduction

In year 2013 was started a short project where the idea was to test different ground geophysical methods for mapping weakness structures in bedrock at Helsinki Capital region. The main idea of the project was to develop integrated geophysical and geological research methods for the urban studies to detect fracturing and orientations of it if possible in the bedrock. One site where the methods were tested is briefly presented here. The site is called Hannusjärvi and it is located in the route of second phase of West Metro line in the City of Espoo in Finland (Figure 1).

The geological interpretation in this project is mostly based on the existing data and interpretations. The West Metro Project in Espoo distributed to this project bedrock drilling data from the Hannusjärvi area.

Methods

The Figure 2a presents the interpretations of weakness zones produced in two old projects. The prevalent fracture directions in bedrock were detected using trend analysis of aeromagnetic high-resolution data (Figure 2b). An association between the orientation magnetic trend lines and fractures. Laser scanning data © National Land Survey of Finland 2015.

The ground geophysical methods utilized and tested together with geological mapping at the test area can be seen in the Figure 3. Figure 4 shows example of the measurements at the example profile L1 visualized more details.

Conclusions

The combined geological and geophysical interpretation illustrated in the Figure 5 gave promising results and new information about the possible fractures and weakness zones in the vicinity of the new metro line.

ERT method worked best for detecting fractures in bedrock in the places with thin soil cover. It also gave a hint of the dip of the bigger fracture boundaries. GPR data gave detailed information about the fractures in the bedrock and it helped in the estimation of the continuation of the fractures visible at outcrops. The ongoing excavation of the metro tunnel gives data to verify the geophysical and structural geological interpretation made in this project.

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