Chapter 7
Geophysical Surveys in Engineering Geology Investigations With Field Examples

Ali Aydin
Pamukkale University, Turkey
Erdal Akyol
Pamukkale University, Turkey
Mahmud Gungor
Denizli Water and Sewerage, Turkey
Ali Kaya
Pamukkale University, Turkey
Suat Tasdelen
Pamukkale University, Turkey

ABSTRACT
This chapter focusses on geophysical survey techniques, employed in engineering geological investigations and it includes case studies. Goal of a geophysical study in an engineering geological research is to display discontinuities in the rock masses, physico-mechanical properties of soils and rocks, groundwater exploration, faults, landslides, etc. It is also helpful to learn type and thickness of soil, layer inclination. These techniques include engineering geological surface mapping, geotechnical drilling and in situ testing. Then the obtained geophysical field data are analyzed and interpreted in conjunction with the results of geological information. The most common geophysical methods namely seismic, magnetometric, vertical electrical sounding (VES), Very Low Frequency (VLF) Electromagnetics methods, ground penetration radar (GPR) provide sufficient information about the subsurface although they have their limitations, setting up the minimum tests requirements in relation to the type of the geological formations.

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1. INTRODUCTION

This chapter focuses on geophysical survey techniques, employed in engineering geological investigations and it includes case studies. Goal of a geophysical study in an engineering geological research is to display discontinuities in the rock masses, physico-mechanical properties of soils and rocks, groundwater exploration, faults, landslides etc. This chapter is beneficial not only for students but also the geological/geotechnical engineers and the contractors to find out the relevant geophysical method(s). Using the geophysical methods in such problems can clear the static and dynamic geotechnical parameters. It is also helpful to learn type and thickness of soil, layer inclination. These techniques include engineering geology surface mapping, geotechnical drilling and in situ testing.

In order to analysis the geophysical studies assume that the medium are homogeneous and the obtained geotechnical parameters reflect the average values of the related medium. Then the obtained geophysical field data are analyzed and interpreted in conjunction with the results of geological information.

The most common geophysical methods namely seismic, magnetometric, vertical electrical sounding (VES), Very Low Frequency (VLF) Electromagnetics methods, ground penetration radar (GPR) provide sufficient information about the subsurface although they have their limitations, setting up the minimum tests requirements in relation to the type of the geological formations. The weakness zones with a nearly vertical orientation are defined by these methods. The VES and seismic methods are most appropriate for vertical delineation of discontinuities. Weathering zones are recognized by lower wave propagation velocities, whereas the resistivity may differ depends on fluctuating hydrogeological conditions. There are different groundwater exploration methods in geophysics and hydrogeology. Groundwater exploration in these disciplines is based on the identifying underground formations, hydrologic cycle, groundwater quality, and detection of nature, number and type of aquifers. Surface geophysical methods, especially electrical and electromagnetic techniques are also commonly employed the groundwater investigation methods.

Geophysical techniques applied by geophysic engineers are becoming popular in the geology, environmental, archeological and civil engineering fields. We will give some field applications samples that where the geophysical techniques are effectively used such as problems. Geophysical techniques can solve the problems of engineering and hydrogeology works are used very effective. However, we prepare this chapter with using geophysical techniques such as magnetic, resistivity, electromagnetic, seismic refraction techniques applied in engineering problems such as in engineering geology, geotechnics, soil-rock mechanics, water and environmental engineering areas. Some data like depth of underground water and subsurface layers, thickness of soils-rocks in the related engineering branches can be tracked and assessed by the geophysical techniques of which commonly gravity, resistivity, magnetic, seismic, electromagnetic and ground penetration radar (GPR).

The physico-mechanical properties of ground can be obtained by the geophysical techniques relatively in short times and economically. Inherently, a geophysical survey planning could be implemented by a geophysicist. This chapter was prepared different engineering problems the geophysical techniques of resistivity, magnetic, seismic, electromagnetic and ground penetration radar (GPR), which can be applied in engineering geology, Geotechnical Engineering, Rock Mechanics and Engineering.

The methods employed in the case studies of engineering geology and geotechnical works were performed in Denizli, Turkey. The engaged geophysical methods in this chapter are magnetic susceptibility, vibrators, resistivity and seismic refraction methods.
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