Interrelation of vertical electrical sounding with geotechnical index properties, lithologies and their thicknesses at Wattar area District Nowshera, KP , Pakistan

Syed Samran Ali[1,2]; Abdul Rahim Asif [1,2]; Nazish Noreen [1,2]; Waqas Ahmed [1]; Sarfraz khan[1]; Muhammad Younis Khan[1] and Muhammad Waseem[1]

[1]National Centre of Excellence in Geology, University of Peshawar

[2]Department of Geology, University of Peshawar

waqas.nce@gmail.com

Abstract

Geo-electrical survey is an attractive tool for delineating subsurface properties without disturbing soil. The use of vertical electrical sounding (VES) in the subsurface investigation has increased in recent years. VES is a non-destructive method and provides a continuous image of the subsurface. The study demonstrates the usefulness of the VES method in geotechnical investigations, which is economic, efficient and less time consuming. A research approach of integrating geophysical and geotechnical engineering parameters for subsoil evaluation is adopted at Wattar area near Nowshera, Khyber Pakhtunkhwa, Pakistan, in order to image the shallow subsurface. A field electrical resistivity survey of 52 m is conducted using Schlumberger configuration. Soil samples are collected from the available exposure for conducting geotechnical investigation in the laboratory. Sieve analysis, Hydrometer analysis, moisture content, Atterberg's laboratory tests (liquid and plastic limits) are performed on these soil samples. From the data analysis, significant correlations have been obtained for electrical resistivity with moisture content, lithology and thickness of a layer respectively. Correlation between lithology of layers and electrical resistivity is achieved by correlating the apparent resistivity values with the standard defined values of resistivity (literature). The field observations show that the top and bottom layer in the area is dominated by gravely sand and clayey sand respectively. The results of sieve analysis and vertical electrical sounding also confirmed these lithologies. The result shows a strong correlation (R2= 0.08) of electrical resistivity with moisture content, lithologies and thickness of a layer. Relationship between moisture content and apparent resistivity values demonstrates non-linear logarithmic correlation. The linear trend line of the curve between moisture content and apparent resistivity shows an inverse relation.