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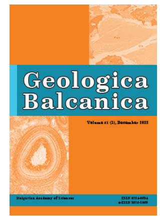

Correlation between effective cohesion and plasticity index of clay

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Abstract. Correlations of engineering properties are a useful tool in geotechnical engineering practice. This paper aims to provide a correlation between the effective cohesion and plasticity index for natural, undisturbed clay soils from the Kozloduy area (NW Bulgaria), based on the results from laboratory tests. It has been demonstrated that there is a strong correlation between the plasticity index and the effective cohesion. The derived regression equation can be used to estimate the effective cohesion as first approximation in preliminary design of engineering projects of Pliocene and Quaternary clays encountered in northwest Bulgaria.

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INTRODUCTION

The effective cohesion (c') of soils is one of the most important soil parameters that is evaluated in slope stability and suitability for building foundations. Effective cohesion is considered as a part of the shear strength that can be mobilized due to forces arising at particle level and is independent from the effective stress (Lambe, 1960). As per Yong and Warkentin (1966), c' of soils is extremely dependent on the interaction characteristics of the clay–water system. Thus, c' is affected by the Atterberg limits of soils.

Essentially, the Atterberg limits are controlled by soil mineralogy, pore structure, and particle size distribution and reflect the ability of fine-grained soil to resist external shear loading (Seed *et al.*, 1966). Atterberg (1911) derives seven limits that describe changes in the behavior of cohesive soils at varying water content. Nowadays, in practice, only three are in use: liquid limit (w_L), plastic limit (w_P) and shrinkage limit (w_S). The liquid and plastic limits represent the plasticity characteristics of soils and are essential in the classification of fine-grained soil. They are also used to calculate the plasticity index (I_P), which could be correlated with many soil properties.

Correlations between the index properties parameters and the strength and deformation properties of cohesive soils are widely employed in geotechnical engineering practices as first approximation of the soil characteristics in the preliminary design of geotechnical structures, and later as a mean to validate the results of laboratory tests (Sørensen and Okkels, 2013).

Beneficial empirical equations associated with various soil properties correlated with Atterberg limits have been provided by many researchers, such as Fener *et al.* (2005), Dolinar and Trauner (2007), Mehta and Sachan (2017), Spagnoli and Shimobe (2020), and others.

Obtaining of the Atterberg limits in a laboratory setting is relatively simple to perform, quick, and inexpensive compared to tests for the determination

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