1014. Correlation between shear wave velocity and cone resistance of Quaternary glacial clayey soils defined by Seismic Cone Penetration Test (SCPT), Lithuania

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Abstract. The correlation between the cone resistance and the shear wave velocities was derived for the Quaternary glacial clayey soil (moraine) using Seismic Cone Penetration Test (SCPT) technique. The correlation obtained between two parameters is as high as +0.73. The derived regression equation has significant differences from those of clayey soils reported from other regions that are accounted to different genetic type of sediments and evolutionary history. Accordingly the obtained results can be applied in defining the dynamic geotechnical properties of glacial clayey soils of Lithuania and other regions that have similar geological conditions (i.e. formerly glaciated areas).

Keywords: glacial, moraine, clay, seismic cone penetration test (SCPT), cone resistance q_c, shear wave velocity v_s.

1. Introduction

Seismic cone penetration testing (SCPT) is increasingly applied technique used for assessment and design of construction foundations. In some cases it is crucial to evaluate the dynamic impact of external and internal vibrations on the constructions with a particular focus on the soil-structure interaction at the design stage. The risks related to the vibrations induced by tectonic forces (earthquakes), wind and water waves, also the liquefaction effects should be taken into account when designing the specific structures such as nuclear power plants, wind farms, offshore platforms [1, 2]. It requires assessment of a number of dynamic geotechnical parameters such as the shear modulus G, the maximum shear modulus G_{max}, the dynamic small-strain shear modulus G_o and the Poisson's ratio v. According to elasticity theory the shear modulus is directly related to soil bulk density and shear wave velocity as shown in Eq. (1):

$$G = \rho v_s^2, \tag{1}$$

where G is the shear modulus, ρ is the bulk density and v_s is the shear wave velocity.

The shear wave velocity is of primary importance in assessing the dynamic soil properties. Variations in seismic velocities are related to specific soil composition, physical state, formation conditions, recent and ancient stresses affecting the body.

The Lithuanian territory is covered by Quaternary glacial sediments that were formed mainly during the last glaciation / deglaciation cycle. About 60 percent of the surface lithologies are represented by clayey moraine. Therefore the knowledge of their dynamic properties, including shear wave velocities, and understanding controlling factors is of primary importance in geotechnical studies of sites of construction of specific structures [3].