Geophysical Research Abstracts
Vol. 17, EGU2015-14359, 2015
EGU General Assembly 2015

Random field theory to interpret the spatial variability of lacustrine soils

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The lacustrine soils are quaternary soils, dated from Pleistocene to Holocene periods, generated in low-energy depositional environments and characterized by soil mixture of clays, sands and silts with alternations of finer and coarser grain size layers. They are often met at shallow depth filling several tens of meters of tectonic or erosive basins typically placed in internal Appenine areas. The lacustrine deposits are often locally interbedded by detritic soils resulting from the failure of surrounding reliefs. Their heterogeneous lithology is associated with high spatial variability of physical and mechanical properties both along horizontal and vertical directions. The deterministic approach is still commonly adopted to accomplish the mechanical characterization of these heterogeneous soils where undisturbed sampling is practically not feasible (if the incoherent fraction is prevalent) or not spatially representative (if the cohesive fraction prevails). The deterministic approach consists on performing in situ tests, like Standard Penetration Tests (SPT) or Cone Penetration Tests (CPT) and deriving design parameters through “expert judgment” interpretation of the measure profiles. These readings of tip and lateral resistances (Rp and RL respectively) are almost continuous but highly variable in soil classification according to Schmertmann (1978). Thus, neglecting the spatial variability cannot be the best strategy to estimated spatial representative values of physical and mechanical parameters of lacustrine soils to be used for engineering applications. Hereafter, a method to draw the spatial variability structure of the aforementioned measure profiles is presented. It is based on the theory of the Random Fields (Vanmarcke 1984) applied to vertical readings of Rp measures from mechanical CPTs. The proposed method relies on the application of the regression analysis, by which the spatial mean trend and fluctuations about this trend are derived. Moreover, the scale of fluctuation is calculated to measure the maximum length beyond which profiles of measures are independent. The spatial mean trend can be used to identify “quasi-homogeneous” soil layers where the standard deviation and the scale of fluctuation can be calculated. In this study, five Rp profiles performed in the lacustrine deposits of the high River Pescara Valley have been analyzed. There, silty clay deposits with thickness ranging from a few meters to about 60m, and locally rich in sands and peats, are investigated. In this study, vertical trends of Rp profiles have been derived to be converted into design parameter mean trends. Furthermore, the variability structure derived from Rp readings can be propagated to design parameters to calculate the “characteristic values” requested by the European building codes.

References

Schmertmann J.H. 1978. Guidelines for Cone Penetration Test, Performance and Design. Report No. FHWA-TS-78-209, U.S. Department of Transportation, Washington, D.C., pp. 145.
Vanmarcke E.H. 1984. Random Fields, analysis and synthesis. Cambridge (USA): MIT Press.