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The influence of selecting the correlation model on soil parameters and bearing capacity

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Consideration of soil spatial variability in the geotechnical design is still marginalized. The design process is based on taking the average parameters, which often results the oversize of geotechnical constructions. This procedure works until there are no geotechnical design problems. In most cases, geotechnical constructions represent a small percentage of the total investment so effects lacking developed of optimization procedures. If the optimization is needed requires the most accurate mapping of the soil. The basic background for statistical interpretation of soil spatially variables are Cone Penetration Tests, which represents variable nature of the soil with depth. Assuming the soil structure as a spatially random variable can be applied by description based on random fields. Field parameters are the probability distribution and correlation model dependent of a scale of fluctuation estimated from CPT. The main goal of this study is to contribute to the understanding on how the choice of correlation model affects random soil properties and for example shallow foundation bearing capacity. The study is particularly focused on scale of fluctuation as related to the reduction of bearing capacity. Scale of fluctuation were estimated using two effective methods: Vanmarcke and Rice.
Soil properties were analyzed from 12 Cone Penetration Tests distributed throughout the regions of Świebodzice (Lower Silesia, Poland). While the project was developed in hilly terrain the macrolevelling were taken involving the displacement of native soil mass to form a working platform for shallow foundation. The construction of embankment has been tested by cone resistance tests to determine the parameters for the design. The procedure adopted to this study include the modeling soil variability from the CPT results and calculate the bearing capacity of shallow foundation using random finite element method and different correlation models. The aim of study was to answer questions: what can be gained by modeling the soil strength parameters as random fields? How will the correlation model adopted in the field influence on the distribution of strength parameters? And finally, would it be visible an impact of the correlation model on the bearing capacity value?
No significant relationships were found between bearing capacity of strip foundation and correlation model. Results show how the empirical correlation coefficient fit to different theoretical correlation functions according to adopted method. Further research is necessary in order to improve how correlation model affects different geotechnical construction.