

Dissertation Release

31st January 2022

Uncertainties related to construction on soft soil areas tackled with reliability analysis

Title of the dissertation	Uncertainty quantification for compressibility and settlement response of clays
Contents of the dissertation	<p>Uncertainties in the mechanical properties of clayey subsoil are among the most significant risks when constructing ground-supported road embankments or other infrastructure. These uncertainties are caused by phenomena such as limited ground investigations and measurement errors. The uncertainty in the settlement prediction for a road embankment can be accounted for through overly cautious design (such as choosing concrete piling over a ground-supported foundation with less emissions) or alternatively, via defining the uncertainties. Once the uncertainties related to the settlement properties of clayey subsoil have been quantified, reliability analysis can be utilised to estimate the probability distribution of the settlement and the probability of exceeding settlement limits. These results provide more accurate insight into the reliability of ground-supported road embankments, which reduces the risk of over-designing and hence contributes to more sustainable construction. However, the use of these probabilistic methods has been quite rare in Finland.</p> <p>The objective of this research was to lay a foundation for performing reliability analysis as a part of settlement estimation when designing infrastructures in Finland. Uncertainties related to the settlement properties of clayey soils were defined by means of statistical methods, and different reliability analysis methods were applied to test embankment case studies. The results demonstrated that, due to the special characteristics of soft Finnish clays, the global literature values and recommendations cannot always be applied. Besides reliability-based design of infrastructures, the results can also be utilised in conventional design according to Eurocode 7, when the characteristic value for a soil property is derived statistically. Further, the compiled clay database and the derived statistics enable preliminary settlement predictions, which are needed in the process of foundation method selection and the assessment of possible need for ground improvement.</p>
Field of the dissertation	Civil Engineering, Geotechnical Engineering
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