THE RELIABILITY ANALYSIS OF SHEET PILE WALL LOCATED IN SOIL WITH RANDOM PARAMETERS

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1. General

The paper deals with reliability analysis of sheet pile wall located in soil with random parameters. The soil has been assumed as purely cohesive frictional with described with Mohr- Coulomb criterion. Spatial variability of friction and cohesion treated as uncorrelated variables has been described using Random Field. Implementation of Local Average Subdivision (LAS) Algorithm (Fenton and Vanmarcke 1990) has been used for generation of the field. Both point statistic as well as correlation length (scale of fluctuation) for assumed exponential correlation model has been estimated using the results obtained with CPTu testing in natural cohesive soils.

Since the data obtained from CPTu and not directly associated with the Mohr Coulomb strength parameters but with the cone tip resistance qc and sleeve friction fs, the point statistic of the friction and cohesion has been estimated using the obtained results together with their correlation to cohesion (undrained shear strength) found in literature. This distribution together with scale of fluctuation estimated for assumed autocorrelation model has been used as basic data set for generation of random field. In order to simplify the calculations while taking into account anisotropy of the soil, the field with random variability in only one direction has been generated. The obtained vertical scale of fluctuation has been applied for description of field variability in the vertical direction - the fluctuation scale in horizontal direction has been assumed as infinite. In the consequence the generated field consists of set of horizontal layers with random parameters.

Using the generated filed of cohesion and friction the probabilistic analysis of sheet pile wall has been performed. The boundary problem of vertical cut in the soil supported with sheet pile wall with determined geometry for soil described with random filed has been considered. The individual realizations of the problem has been solved using FLAC software. For both cantilever and anchored wall displacement, maximum bending moment and force in anchor has been calculated. The Monte-Carlo Simulation consisted of 10000 realizations. The results has been presented in form of the histograms of values of the quantities over realizations.

In the final step of the calculation reliability analysis have been performed. For this purpose the approximated histograms have been used. Both ultimate (based on values of maximal bending moment and force in anchor) and serviceability limit state (based on value of displacement) have been tested. The obtained results prove usefulness of the presented methodology for reliability based design of sheet pile walls.

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