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Reliability Based Performance Evaluation of Stone Column Improved Soft Ground

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Abstract : The present study considers the effect of variation of different geotechnical random variables in the design of stone column-foundation systems for assessing the bearing capacity and consolidation settlement of highly compressible soil. The soil and stone column properties, spacing, diameter and arrangement of stone columns are considered as the random variables. Probability of failure (P_f) is computed for a target degree of consolidation and a target safe load by Monte Carlo Simulation (MCS). The study shows that the variation in coefficient of radial consolidation (c_r) and cohesion of soil (c_s) are two most important factors influencing Pf. If the coefficient of variation (COV) of c_r exceeds 20%, P_f exceeds 0.001, which is unsafe following the guidelines of US Army Corps of Engineers. The bearing capacity also exceeds its safe value for COV of c_s > 30%. It is also observed that as the spacing between the stone column increases, the probability of reaching a target degree of consolidation decreases. Accordingly, design guidelines, considering both consolidation and bearing capacity of improved ground, are proposed for different spacing and diameter of stone columns and geotechnical random variables.

Keywords : bearing capacity, consolidation, geotechnical random variables, probability of failure, stone columns
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