Reliability-Based Method for Assessing Liquefaction Potential of Soils

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Abstract : This paper explores probabilistic method for assessing the liquefaction potential of sandy soils. The current simplified methods for assessing soil liquefaction potential use a deterministic safety factor in order to determine whether liquefaction will occur or not. However, these methods are unable to determine the liquefaction probability related to a safety factor. A solution to this problem can be found by reliability analysis.This paper presents a reliability analysis method based on the popular certain liquefaction analysis method. The proposed probabilistic method is formulated based on the results of reliability analyses of 190 field records and observations of soil performance against liquefaction. The results of the present study show that confidence coefficient greater and smaller than 1 does not mean safety and/or liquefaction in cadence for liquefaction, and for assuring liquefaction probability, reliability based method analysis should be used. This reliability method uses the empirical acceleration attenuation law in the Chalos area to derive the probability density distribution function and the statistics for the earthquake-induced cyclic shear stress ratio (CSR). The CSR and CRR statistics are used in continuity with the first order and second moment method to calculate the relation between the liquefaction probability, the safety factor and the reliability index. Based on the proposed method, the liquefaction probability related to a safety factor can be easily calculated. The influence of some of the soil parameters on the liquefaction probability can be quantitatively evaluated.
Keywords : liquefaction, reliability analysis, chalos area, civil and structural engineering

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