Interaction of Geotechnical and Structural Variabilities in Reliability Assessments of Retaining Walls

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Abstract: This paper presents the reliability assessment for three types of retaining walls, including deep cement mixing (DCM) retaining wall and reinforced DCM wall, both embedded in soils, and DCM wall founded on stiff stratum, with the spatially variable soil and wall materials individually modeled by the random field theory. The random field realizations are generated by Latin hypercube sampling with dependence (LHSD), which is a stratified sampling technique that preserves the spatial autocorrelation characteristics of the materials. For each set of variability features, 1000 realizations are generated, and the subsequent analyses are performed in *FLAC3D*, with the numerical model verified by a series of mesh refinement studies. Both the spatially variable soil and wall materials are shown to significantly affect the system response, and their relative contributions are elucidated through the probabilistic analyses with different combinations of soil and wall property variations. The results show how the overall performance uncertainty may be affected by the types of retaining walls, and the variability in geotechnical and structural materials. Through these analyses, this paper aims to demonstrate the needs to consider both the geotechnical and structural variabilities in probabilistic analyses, and reappraise the performance discrepancies between these types of walls from the perspective of spatial variability in the materials.

Keywords: Retaining wall; soil-structure interaction; spatial variability; probabilistic analyses; random field modeling.