STIFFNESS OF SOIL-GEOSYNTHETIC COMPOSITE UNDER SMALL DISPLACEMENTS: I. MODEL DEVELOPMENT

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Abstract: While significant emphasis has been placed on the quantification of soil–geosynthetic properties under failure conditions, studies of properties that are suitable for characterizing this interaction under serviceability conditions have been limited. Also, most geosynthetic properties are currently defined in isolation rather than under the confinement of soil. The purpose of this study is to develop a soil–geosynthetic interaction framework that, with a single and repeatable parameter, can capture the stiffness of a soil–geosynthetic composite under small displacements. The soil–geosynthetic interaction model developed in this study involves well-established force equilibrium differential equations. However, the constitutive relationships and boundary conditions were specifically selected so that the model results in a closed-form analytical solution. Since the analytical solution involves a single parameter, its use may be particularly suitable for specification and the design of structures such as stabilized roadways. This parameter, referred to as the stiffness of the soil–geosynthetic composite, or K_{SGC}, captures both the tensile characteristics of the geosynthetic and the shear behavior of the soil–geosynthetic interface. Experimental procedures to quantify K_{SGC} were developed as part of this study. The results of a pilot experimental program, conducted using tailor-made soil–geosynthetic interaction equipment, are presented in the paper. These results confirm the suitability of the assumptions and outcomes of the model. A companion paper provides the results of a comprehensive experimental program with particular emphasis on the evaluation of the repeatability of the results and on the sensitivity of the assumptions and outcomes of the model to variables that impact K_{SGC}.

Full reference:

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