

STIFFNESS OF SOIL-GEOSYNTHETIC COMPOSITE UNDER SMALL DISPLACEMENTS. II: EXPERIMENTAL EVALUATION

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Abstract: While most soil–geosynthetic interaction models have focused on the characterization of failure conditions, little emphasis has been placed on models and parameters suitable for characterizing the stiffness of soil–geosynthetic systems. In the companion paper, a soil–geosynthetic interaction parameter (K_{SGC}) was developed that captures the stiffness of a soil–geosynthetic composite under small displacements. This included validation of the suitability of the assumptions and outcomes of the model for a specific set of materials and testing conditions. This paper presents the results of a comprehensive experimental program that allows the suitability of the model to be generalized for a wider range of materials and testing conditions. An initial test series was conducted using large-scale soil–geosynthetic interaction test equipment to evaluate the repeatability of the experimental results. A comparison of the test results from this series, as well as an assessment of an extensive database on the expected variability of soil and geosynthetic properties, revealed that the coefficient of variation of the model parameters was acceptable and well within the typical range of similar geotechnical and geosynthetic properties. Results from additional test series confirmed the linearity and uniqueness of the relationship between the geosynthetic unit tension squared and corresponding displacements, which are the key features of the proposed model. These tests were conducted under various conditions using different geosynthetic and backfill materials. Results also showed that the constitutive relationships adopted in the model were adequate for the extended range of confining pressures, geosynthetic lengths, geosynthetic types, and backfill soil types adopted in the study. The consistency of the results obtained in the experimental testing program underscores the suitability of the proposed K_{SGC} parameter as a basis for the evaluation of soil–geosynthetic interactions under small displacements.

Full reference:

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