Principle Investigation and Description of the Stress-Strain Behaviour of the Composite Material "Geogrid Reinforced Soil"

Current design concepts for geogrid reinforced soil structures are mainly based on empirical studies and require high safety factors, which subsequently lead to ineffective designs. Furthermore, the description of the composite material with discrete modeling of its two components is not satisfactorily possible with the finite element method as the load transfer between soil and geogrid is characterized insufficiently with common interface elements.
Therefore, the aim of this research project is to investigate the principle stress-strain behavior of the composite material "geogrid reinforced soil" and to describe its general mechanical functioning. So far mainly pull-out tests and application-oriented model tests have been carried out. However, to quantify the influence of the main parameters of the components soil and geogrid as well as of the resulting composite material, preferably simple tests with boundary conditions similar to those from element tests are necessary. For this, a laboratory apparatus has recently been developed to carry out large scale biaxial compression tests under plane strain conditions. In addition to the determination of the global stress-strain behavior, the specimen deformation of the complete cross-section throughout the entire test is obtained through the transparent side wall. The dimensions of the test device allow the use of non-scaled geogrids. The biaxial compression tests are the key aspect of this research project.
The resulting dependencies serve as a general basis for the estimation of the load bearing and deformation behavior of geogrid reinforced soil structures. In particular, a model for the realistic description of the load transfer between soil and geogrid is developed by using the interaction-relevant state variables obtained from the comprehensively instrumented laboratory tests. On the basis of the developed interaction model, a generally-applicable interface element for the composite material geogrid reinforced soil in finite element calculations is created. Thereby, it will be possible to calculate both ultimate limit states and the deformation needed for serviceability states.

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