



A new inclinable shear apparatus for large sample testing: design and perspectives

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Soil bioengineering methods are commonly applied to protect slopes from erosion and shallow landslides. However, the precise effectiveness of vegetation regarding slope stability is difficult to determine. Root reinforcement can be evaluated directly in terms of the additional shear strength provided by roots in root-reinforced soils. In this context we designed a shearing device for large scale planted soil samples with the aim to provide information about the contribution of plant roots to soil shear strength.

The apparatus allows investigations on soil block samples with roots of different plant species commonly used for remediation and habitat restoration purposes under almost natural conditions. Shear stress results of rooted soils can be compared to those of un-vegetated soils with similar soil types. New and different to conventionally applied concepts, shear tests can be performed at variable inclinations up to 45°, considering plant growth at the corresponding angle of slope. Furthermore, experiments can be conducted at variable depth of the shearing zone, with low normal stresses and low shearing rates of ≥ 0.01 mm/min. The measurements involve shearing force, shearing displacement (up to 200 mm), normal stress, normal displacement (dilatancy/consolidation) all recorded with high accuracy. Saturated and partially saturated soil samples containing roots can be tested with the soil humidity measured near the shearing zone. An automatic data logging system was designed for real-time visualisation of the different parameters and recording all required data in conjunction with the described direct shear apparatus.

The device for soil samples of up to 500 x 500 x 400 mm offers a unique possibility to span the gap between investigations concerning vegetation effects on small planted soil specimens (e.g. triaxial tests) and the calculation of slope stability on entire slopes with vegetation. In addition, it combines the advantages of laboratory tests under clearly defined conditions with in situ tests performed on soil with natural vegetation.