Geophysical Research Abstracts,
Vol. 11, EGU2009-7206, 2009
EGU General Assembly 2009
© Author(s) 2009

Evaluation of roots mechanical contribution to slope stability by finite element modelling

F. GENTILE (1), G. ELIA (2), and R. ELIA (1)

(1) Dept. of Engineering and Management of the Agricultural, Livestock and Forest Systems (PROGESA), University of Bari, Italy (francesco.gentile@agr.uniba.it), (2) Dept. of Environmental Engineering (DIASS), Technical University of Bari, Italy

The paper deals with the assessment of vegetation contribution to slope stability, with particular emphasis on the mechanical effects provided by the root apparatus. As it is well known, the presence of a root system within the soil increases, with respect to the case of soil without vegetation, the material effective cohesion with no significant change in its friction angle. Such mechanical effect can be introduced in the Mohr-Coulomb failure law through an “apparent cohesion” term, which adds to the soil effective cohesion.

The contribution of root reinforcement to the soil shear strength has been investigated in slope stability finite element analyses, modifying the soil properties of individual slope elements affected by vegetation. This approach allowed to quantify the effect of the mechanical root reinforcement on the slope factor of safety, assessing the sensitivity of slope stability to the variation of apparent cohesion and root zone depth assumed in the numerical simulations.

When the failure mechanism inside a slope without vegetation starts from his toe and is planar and shallow, the introduction of vegetation confined along the slope surface only results in a small increment of the safety factor. If the slope toe elements are treated as vegetated soil or the vegetation extends over the entire ground surface, the increment of the slope safety factor is significant. In these cases, the effect increases as much as the root apparatus extends in depth, reaching the zones where the failure mechanism is initiated. Consequently, the critical slip surface is shifted deeper below the ground surface, becoming circular. The sensitivity analysis indicates that the vegetation mechanical effects are less significant in slopes with high values of effective cohesion where deep-seated failure mechanisms are likely to occur. Moreover, the existence of a water table at ground surface does not generate any considerable change in the general framework observed during finite element analyses of slopes without water.