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Residual shear strength and shallow landslides: a study on weathered fine grained soils outcropping in the Daunia Mts. (Southern Italy)

G.F. Andriani, M. Moretti and N. Walsh

Dipartimento di Geologia e Geofisica, Università degli studi di Bari, Via Orabona 4, 70125 Bari, Italy

(gf.andriani@geo.uniba.it; m.moretti@geo.uniba.it; nwalsh@geo.uniba.it)

In the stability analysis of slopes, environmental conditions and soil properties play an important role aimed at the interpretation of the mechanisms of movement. Slope behaviour is very complex and depends on the mechanical processes implying shear deformation and rupture. To assess the stability of slopes shear strength parameters of soils are needed, especially cohesion and friction angle for both drained and undrained conditions.

The Daunia Mts. belong to the outermost sector of the southern Apennine chain and are located at the north-western boundary of Apulia (southern Italy). They are characterised by low structural and topographic elevation, only locally exceeding 1000 m above sea level. The geological setting is very complex and represented by a series of tectonically deformed turbiditic formations of pre-Pliocene age covered by discontinuous Quaternary and Holocene deposits including terraced alluvial deposits and colluvial slope sediments. The outcropping units are rich of weathered argillaceous deposits in chaotic setting and prone to landsliding. The Daunia Mts. is in fact characterised by widespread activity of slope movements, mostly related to the reactivation of pre-existing landslides. Remobilisation processes of slope movements are seasonal and occur, mostly, during or after periods of prolonged meteoric events (mean annual rainfall is about 700 mm). As regards the principal modes of slope deformation, the most common types of mass movement are shallow slips, flows and complex landslides consisting of rotational slumps evolving to flows.

In this study, particular attention was given to shallow landslides involving weathered clayey soils in the area between the villages of Motta Montecorvino, Pietra Montecorvino and San Marco la Catola. Physical and shear strength parameters were determined for undisturbed and remolded soil specimens by means of standard geotechnical laboratory tests. Direct shear tests were performed to investigate the shear behaviour and determine the residual shear strength of the soils. A Casagrande-type shear box was used for the shear tests. Several specimens were tested to a selected vertical stress, under consolidated-drained (CD) and consolidated-undrained (CU) conditions. The field residual shear strength was evaluated by multiple reversal direct shear tests on cut-plane samples.

Landslide map (1: 10000 in scale), produced by the combination of field research (geological-geomorphologic survey) and the interpretation of aerial photographs was compared with engineering slope safety factor map (1: 10000 in scale) to obtain a resulting map which gives spatial landslide susceptibility (landslide potential map).