SHEAR BEHAVIOUR OF TECTONIZED CLAY SHALES: A DISCONTINUUM APPROACH

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The mechanical behaviour in shear of tectonized clay shales was investigated through the analysis of the results of drained direct shear and triaxial tests on materials belonging to several formations from different regions of Italy. Data were collected both from literature and laboratory tests conducted by the authors in the course of time and not extensively published yet.

Tectonized clay shales are widespread in Italy from north to south. They are found in different types of geological formations with different structural roles including: matrix of BIM/melange formations, layers in regularly stratified or intensely folded flysch formations, interlayers within hard rock formations as limestones or sandstones.

Their particular behaviour pose severe problems during excavation of tunnels and cutslopes as well as large foundations and natural slopes.

Tectonized clay shales are assemblages of stiff clay scales bonded together. The distinctive characters of the material fabric are: size, shape, orientation and strength/stiffness of the scales, state of scale surfaces and degree of bonding among the scales. They vary for different geological formations and within the same formation as well. All the tested materials have the same general structure with different incidence of the various structural features.

Experimental results were interpreted with the aid of numerical models. To reproduce its actual structure, the material was schematized as a discontinuum where each scale is modelled. To focus on the material structure and reduce complexity of the numerical model, direct shear tests were modelled in two dimensions. For the same reasons constitutive models of the scales and their interfaces were chosen as simple as possible. Analyses were conducted with the UDEC distinct element code. Various models were set up to explore different geometrical configurations of the scales in term of shape and size, as well as different values of strength and stiffness of the scales at the scale surfaces were explored. Experimental and model-predicted behaviour for the different materials were compared. Comparison regarded shear stress-shear displacement curves, normal displacement-shear displacement curves, envelopes of shear stress-normal stress pairs at peak and variation of dilation with shear displacement and normal stress.

Modelling allowed us to link the distinctive features of the mechanical behaviour in shear to structural characters of the material and confirmed that these materials can be likely assimilated to a discontinuous medium.