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An example of a complex rock slope failure investigated by means of Laser Scanner Technique and numerical modelling

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On March 12, 2005 a rock slope failure occurred in the Scascoli Gorges (Savena Valley, Northern Apennines, Italy), damming the torrent below. The collapsed rock mass was characterized by a failure surface progressively changing from over-steepened at the top to concave at the bottom. Terrestrial laser scanner technique (TLS) has been applied to obtain high resolution topography of the rock slope. Mechanism and kinematics of the rock slope failure has been investigated by a 2D elasto-plastic finite element program (Phase2) and by a 2D distinct-element code (UDEC), simulating the progressively developing damage of the rock mass by reducing the GSI initial value and using the Hoek & Brown constitutive model. Strength and deformation properties of both intact rock and discontinuities were estimated from laboratory tests and by field surveys as well. As numerical simulation in rock masses largely depends on joint pattern and orientation, accurate discontinuities spacing and location of discrete surface features have been directly gathered from data provided by TLS. Results show the presence near the toe of a yielding zone due to shear damage changing, as deformation process occurs, into a tensile failure zone progressively propagating through the intact mass. The failure seems, then, to be controlled by both brittle fracture propagation through intact rock bridges and the orientation of natural discontinuities finally evolving into a massive toppling/rock fall. The contribution of the TLS technique has shown to be absolutely relevant, as it gave a detailed and immediate knowledge of the structural setting of the rock mass, directly usable in the numerical analysis. In a more general context, the study confirms the benefits of integrating numerical modelling techniques with site investigation, laboratory testing and in situ monitoring campaigns as well. It

is, however, essential that quality and quantity of both input and instrumentation data be improved at the same time in order to provide the required validation.