Geophysical Research Abstracts
Vol. 13, EGU2011-8651, 2011
EGU General Assembly 2011

The importance of the geological model in large slope instabilities: the case of Marinasco-Strà landslide (Eastern Liguria, Italy)

Daria Marchetti, Giacomo D'Amato Avanzi, Roberto Giannecchini, and Alberto Puccinelli
Earth Sciences Department - University of Pisa, Via S. Maria, 53 - 56126 Pisa (Italy) (marchettid@dst.unipi.it)

Since the mid-90's the arch of hills which shuts in the La Spezia Gulf (Eastern Liguria, Italy) has been involved in the reactivation of large landslides, also induced by the construction of a road tunnel. These movements caused extensive damages to many buildings, such to declare a state of emergency and evacuation.
In order to define the landslides geological model and to understand the causes that induced the movement, specific geological and geomorphological surveys, geotechnical and hydrogeologic surveys (boreholes, kinematic and geomechanical characterization of rock and soils, refraction and reflection seismic surveys) and monitoring systems (piezometers, inclinometers, extensometers) were carried out.
The high degree of the rock mass fracturing, its lithological heterogeneity (a thick Maastrichtian-Paleocene siliciclastic flysch), the presence of landforms related to ancient and deep gravitational movements and thick debris covers in a precarious balance on the slopes are evident.
The surveys were not performed on all the landslides affecting these slopes, but only where high vulnerability is clear. In the worst area, immediately next to the village, at least three rotational slides were identified and analyzed: a) a shallow landslide, with a sliding surface located at a depth of 10-13 meters, which includes sands, silts and sandstone weathered blocks; the mass has low permeability. A water table can be observed in rainy periods, with a piezometric level of about 3-4 meters below the topographic surface; b) an intermediate landslide, with a sliding surface located at a depth of 25-30 meters, including fractured and highly altered sandstones with abundant pelitic matrix, generally impermeable; c) a deep landslide, whose lowest surface was not reached by the drillings, but assumed at a depth of around 100 m on the basis of geomorphologic evidences individuated by aerial photo analysis; it is probably constituted by the same material of the "intermediate landslide", but less fractured, as evidenced by the higher Vs waves propagation speed (800-900 m/s instead of 500-700 m/s of the intermediate body).
Then some stability analyses (3D numerical modelling) were performed in order to explain the mechanisms causing the observed landslides and their evolution in term of displacements and deformations.
The multidisciplinary approach allowed to correlate the local data, derived from surveys and monitoring, with the results derived from numerical analysis. This integrated approach allowed the design of different remedial works for different areas of the slope. They consisted in the building of: a) four structural wells (diameter of 12 m and 30 m deep), anchored on 3 levels, b) a concrete belt at the same level of the foundation to the north, south and east of an ancient church, based on piles and connected with "teeth" to the foundational structures, c) an anchored wall, based on very close to each other piles and about 20 m deep.