

# Effect of slow-moving landslides on churches in the Liguria region: a geotechnical approach

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## ABSTRACT

Protecting cultural heritage from water-soil interaction related threats is a current issue and the prediction of the effect induced on buildings by landslide is very challenging. The difficulty lies both in the modeling of the landslide and, specially, in the evaluation of its effects on buildings. According to many authors [1] [2] different factors contribute to the difficulty of modelling landslide, such as the strongly site-specific nature of landslide phenomena, the lack of accurate observational data of intensity and different time and geographical scales involved as well. This paper concerns the study of the effects of a particular category of landslides, active rotational and translational slides with movement rates of the order of some mm/year, on buildings of historical and cultural interest such as churches. The latter are quite different from masonry buildings: the lack of floors and internal walls, the presence of arches and vaults and of large openings, make this structural typology different from the others especially if studied to evaluate the effects of the slope movements. Hence, a thorough analysis of a large number of churches subjected of active landslide have been carried out for Liguria region, which is very exposed to landslide phenomena. Firstly, geotechnical data for each area has been collected (i.e. borehole, inclinometer, in situ test results). Then, with a GIS software and the acquisition of DTM data of the area, it was possible to obtain a sufficiently precise topographic survey, in order to trace representative sections along the slope, particularly along the direction of the landslide. Both limit equilibrium (LEM) and FEM analyses were performed in order to associate slope displacements with slope safety factors and the hazard factor FH [3]. Concurrently, inspections on site were carried out and the damage patterns were surveyed in detail. The results of the numerical analyses, in terms of displacements and FH, were linked to the damages observed in the churches in order to individuate the damage mechanism associated with the slope movement phenomena.

## REFERENCES

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