

# PHYSICAL AND NUMERICAL MODELLING OF SOIL STRUCTURE INTERACTION AND DAMAGE OF STRUCTURES DUE TO GROUND MOVEMENTS

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**S**tructures, in particular unreinforced masonry are critically susceptible to ground movements because of their low tensile strength. Ground movements due to natural and man-made settlement, underground cavity collapse or mining/tunnelling induce slight to severe damages on structures and infrastructures. The evaluation of the level of damage is still under research investigation due to the complex phenomenon of soil structure interaction. Empirical approach is generally used to evaluate the damage, but presents a serious limitation. This keynote lecture focuses on the use of advanced physical modelling (1-g and n-g) and numerical modelling (continuous and discontinuous) to better evaluate the damage due to ground movement and associated soil structure interaction. The presentation first addresses the effect (damages) of ground movement on structures and infrastructures illustrated by in situ observations, then a large overview of the use of 1-g physical and numerical models to solve geotechnical problems and soil structure interaction related to vertical ground movement will be made. The second part of the presentation will focus on the illustration of the usefulness and the advantages of 1-g physical modelling to study the masonry damage due to ground movement. A large scale 1-g physical model developed recently by Ineris with a 6 m<sup>3</sup> container and 15 electric jacks will be presented. Thanks to physicalnumerical modelling and in situ observation, a new methodology and criterion were developed based on the local and global damage of the structure. The new equipment offers the possibility to study different geotechnical and soilstructure problems. The model uses image correlation technique to evaluate precisely the damage of the structure. The model capacity is demonstrated in the case of the analysis of damage in a masonry structure (based on a digital image correlation technique) where the influence of the position of the structure onto the subsidence through is analysed in terms of cracks density and damage level of structures.

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