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Comparative micromechanical assessment of adobe and clay brick masonry assemblages based on experimental data sets

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Abstract

Many existing structures worldwide are made of adobe masonry (AM) or clay brick masonry (CBM). In this study, the influence of different mechanical properties for bricks and mortar on global behaviour of AM and CBM is investigated through micromodelling and homogenisation. Firstly, a large number of experimental data on mechanical properties of bricks and mortar was collected and analysed for both AM and CBM. Micromechanical analysis was then carried out accounting for statistics and robust empirical models, which were derived for strengths and elastic moduli of bricks and mortar through an experimental data analysis. Masonry was modelled as a periodic composite made of two components representing bricks and mortar. Finite element homogenisation analysis was performed on running bond AM and CBM assemblages to determine their critical curves and homogenised properties. Each critical curve provides the masonry average stresses corresponding to initiation of damage in masonry, which was assumed to be subject to a plane average stress state. In the plane of normal and shear average stresses, critical curves are similar to Mohr-Coulomb failure curves with nonlinear cap in compression. Those curves show that initiation of damage is very sensitive to the difference between Young's moduli of brick and mortar.

Keywords: Mechanical properties; Experimental data; Micro-mechanics; Finite element analysis; Adobe

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