

CODE 116**NUMERICAL SIMULATION WITH MACRO ELEMENTS OF OUT-OF-PLANE
FAILURE IN ADOBE BUILDINGS UNDER SEISMIC LOADS**

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ABSTRACT

Ecuador is located on the eastern rim of the Pacific Ring of Fire, an area known for its seismic activity. One notable city in Ecuador is Cuenca, a historical center of UNESCO World Heritage Trust since 1999, due to its many historic buildings often featuring adobe walls. This paper aims to numerically simulate the out-of-plane failure of three adobe facades representing typical buildings in Cuenca - Ecuador using homogenized properties of adobe to estimate the seismic resistance of these walls. A micro-model approach using a damaged-based model with material properties from experimental tests on units and piers defines the homogenized properties of adobe. The methodology uses numerical analyses of Representative Volume Elements (RVEs) to characterize the complex behavior of adobe and define orthotropic homogenized properties. Further, with the homogenized approach, it is possible to numerically represent the walls and obtain their capacity curves using displacement-based pushover analyses. Finally, the damage is characterized as a function of inter-story drift. The numerical method has been proven accurate and efficient since it uses a mixed implicit-explicit integration scheme. Moreover, it can capture in-plane and out-of-plane tensile, compression, and shear failure modes. This methodology can be extended to characterize complete 3D adobe structures with relatively little complexity. Future research in this area could improve our understanding of the structural behaviour for entire adobe buildings and aid in conserving historic buildings by proposing retrofitting techniques that improve seismic strength.