On the use of wooden beams as an anti-seismic device in stone masonry in Qasr el-Bint, Petra, Jordan

Abstract

Timber string-courses have clearly been used to strengthen stone ashlar buildings in Petra, Jordan. These embedded beams, used as a form, held the brittle stone ashlars together, especially during earthquakes. In this study, tied and frictional surfaces were used to represent the interaction between the masonry blocks and the embedded wooden beams. Micro and macro modelling were used to evaluate the effect of using the embedded wooden beams on the integrity of the sandstone monument Qasr el-Bint. The traction-separation behaviour of the cohesive element was employed to model the mortar joints. A continuum, plastic-based, damage constitutive model (CDP) was used to represent the behaviour of the masonry walls. The results of these investigations demonstrated the role of the embedded wood string-courses as an anti-seismic device in reducing the shear stress of the stone masonry structure by up to 33%. The repairing and preserving of these beams that function as antiseismic devices are needed to strengthen the structure against potential earthquakes.