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Parametric Finite Element Analysis of Confined Masonry Walls Strengthened with Fabric Reinforced Cementitious Matrix

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Abstract

Confined masonry (CM) construction is popularly practiced in many countries as it generally performs better than unreinforced masonry and non-ductile RC infill masonry under seismic loads. However, the confined masonry buildings have al-so experienced damage during past earthquakes. Poor seismic performance is generally seen due to construction errors, design flaws or material deficiencies in the building design and construction process. To overcome these deficiencies, there is a need to strengthen the confined masonry structures. Thus, this paper focuses on developing a numerical model to study the in-plane seismic behavior of CM walls strengthened using Fabric Reinforced Cementitious Matrix (FRCM). Based on previous experiments and literature studies, a three dimensional (3D) finite element macro-modelling technique was developed using the commercial software package ABAQUS for solid CM walls and infill-RC wall strengthened with glass FRCM.

The strength and stiffness degradation of masonry, cementitious matrix and concrete was defined using Concrete Damaged Plasticity (CDP), which is a damaged plasticity-based continuum constitutive model. The masonry panel, RC tie-frame, strengthening composite and reinforcements were discretely modelled. The calibrated FE model showed close prediction of numerical results with the past experiments. Thus, the proposed model was used to conduct the parametric FE study on CM walls strengthened with FRCM. Three different aspect ratios for solid CM walls, masonry strengths and different type of FRCM composites were considered for this parametric study. In addition, the effect of one side and two-sided strengthening was taken into consideration. The results of parametric study provide understanding on influence of various parameters on the lateral load response of CM walls strengthened with FRCM.

Keywords: Finite element modelling, FRCM strengthening, Confined masonry