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ANALYTICAL APPROACH TO SEISMIC BEHAVIOUR ASSESMENT OF RC FRAME STRUCTURES WITH RUBBER JOINTED MASONRY INFILL

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1. Introduction

Infilled structures are the most used type of structures in seismic-prone countries and masonry infills are the most vulnerable part of these structures, even under medium-intensity earthquakes. Recent experimental and numerical studies demonstrated that decoupling systems between the infill and the surrounding frame reduce the adverse effects of the frame-infill interaction on the ductility of the system [1].

2. Description of prototype and experimental campaign

Full-scale prototype was subjected to shaking table tests conducted within the ERIES – FLEJOI project by a research group at the Institute of Earthquake Engineering and Engineering Seismology – Skopje, North Macedonia. It consists of one bay, one height reinforced concrete frame structures (as shown in Figure 2a) and masonry infilled wall that is decoupled from the surrounding frame with rubber flexible/ sliding joints with suitable stiffness (Figure 2b).

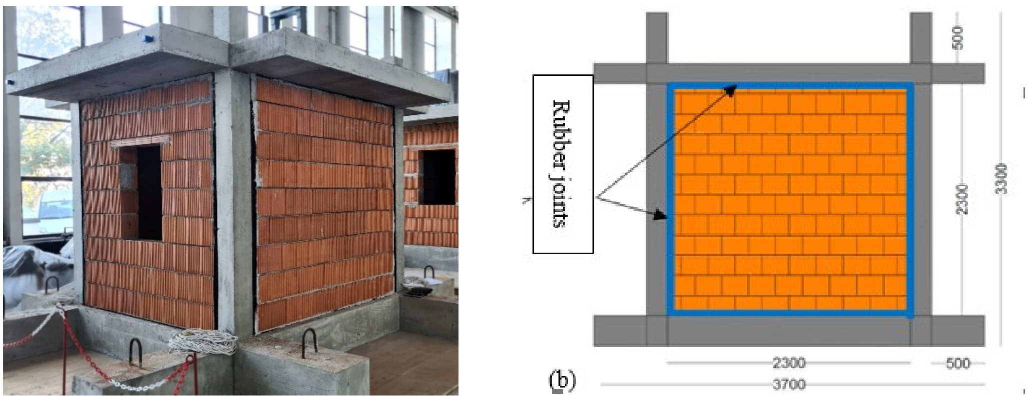

Figure 2. a) Built experimental model; b) Positioning of rubber joints

The following experimental activities were performed by the Dynamic Testing Laboratory of IZIIS [2]: 1) characterisation tests of the constituent materials and components, 2) ambient vibration and impact hammer tests conducted to ascertain the dynamic characteristics and 3) shake table tests aimed to evaluate the dynamic behaviour and seismic response to specific earthquake time histories.

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3. Adopted modelling strategy

The main focus of this paper is to investigate the applicability and accuracy of a discrete macro element as a practical numerical tool for assessment of decoupled RC masonry-infilled frames equipped with rubber joints alongside the frame.

The model (Figure 3b), implemented in OpenSees, can be represented by a simple equivalent mechanical scheme consisting of an articulated quadrilateral panel with a 1D diagonal link simulating the masonry shear deformability and eight 2D perimeter contact links governing the masonry axial and flexural responses and the infill-frame interaction (Figure3.a) [3][4].

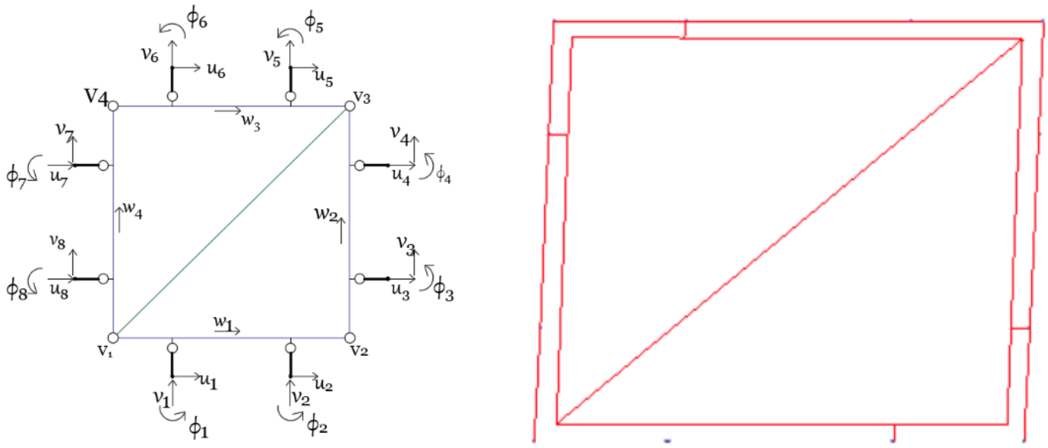

Figure 3. a) Schematic presentation of the discrete macro model; b) Numerical model of one discrete macro element in Open Sees

The experiment results demonstrate that these flexible joints aid in improving and balancing the structure's bearing and ductility capacity and protect the masonry of pre-term damage. The comparisons between the numerical analyses and the experiments, presented in terms of displacement time histories and damage patterns are in the calibration process and to date demonstrate that the macro-element can predict the complex non-linear dynamic response of the system with reasonable accuracy.

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