Protección sísmica de muros de mampostería para estructuras ubicadas en zonas de alta peligrosidad sísmica en España, aplicable a un edificio en el sur de la provincia de Alicante

Máster en Ingeniería de Caminos, Canales y Puertos
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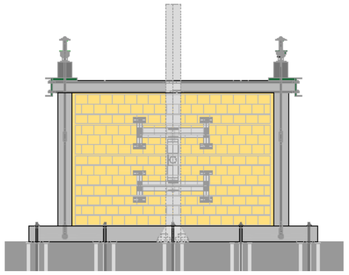
1. Description of the project

- Developing **numerical models** of masonry infill walls with the software **Abaqus** in order to compare them to experimental models carried out in the University of Padova (Italy).
- The masonry walls are designed with and without **rubber joints** and they are subjected to loads representing a seismic action. The project focuses on **out-of-plane loads.**
- Results are compared to the ones obtained with the experimental models and they allow to identify the **effectiveness of rubber joints** in reducing the infill damage during a seismic event.

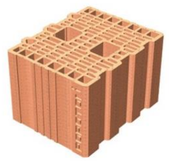
2. Experimental models

Experimental tests were carried out **with and without rubber joints** and considering the action of **out-of-plane loads**, as part of a project called INSYSME.



Main elements of the walls

- Reinforced concrete frame
- Vertically perforated bricks
- Mortar joints
- Rubber joints



Loads

- Self-weight
- Vertical loads simulating upper floors in a building
- In-plane load
- Out-of-plane loads

} **Seismic action**

3. Numerical models

Two approaches → **Macroscale**, **Mesoscale**

Macroscale models

- **Simplification** of the experimental models
- Bricks are introduced as **plates** not as single units
- Allow to study **the efficiency of rubber joints**

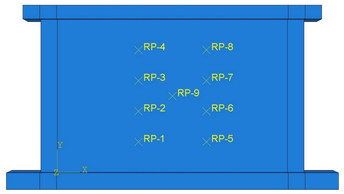
Mesoscale models

- **Accurate representation** of the experimental models
- Bricks are **detailed one by one**
- Response of the wall is **more similar** to the experimental one

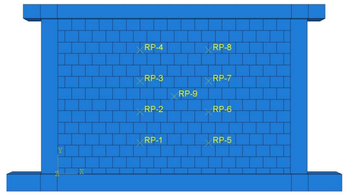
Inside each approach → **Mortar joints**, **Mortar + rubber joints**

Mortar joints

Macroscale

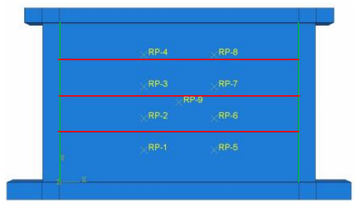


Mesoscale

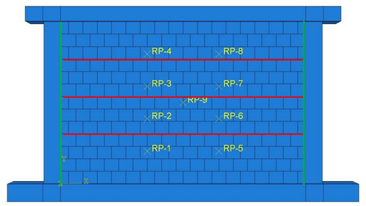


Mortar + rubber joints

Macroscale



Mesoscale

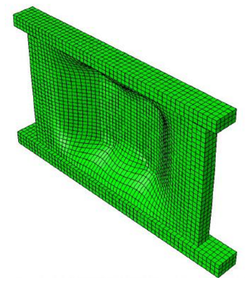


Lines in colours represent the location of rubber joints, which are introduced in the models as interaction properties.

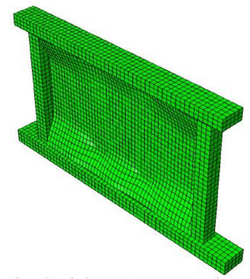
4. Results

Macroscale models

Mortar joints



Mortar + rubber joints



Mesoscale models

After studying the experimental and numerical mesoscale models, it can be said that:

- Rubber joints mainly **improve the behaviour** of masonry infill walls against in-plane loading, but also when **out-of-plane** loads are acting.
- These joints **prevent the damage** of bricks.

5. Application to Spain

Studied location:

Orihuela (Alicante)

Basic seismic acceleration:

$$a_b \geq 0.16g$$

After comparing the acceleration in Orihuela and the acceleration that the forces induced in the numerical models, it can be said that a building with rubber joints would be able to withstand a seismic event without collapsing, although further work should be carried out to confirm these results.