



9th EWICS



**TÉCNICO
LISBOA**

**9TH EUROPEAN WORKSHOP ON THE SEISMIC
BEHAVIOUR OF IRREGULAR AND COMPLEX STRUCTURES**

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**Evaluation of the effectiveness of
accidental eccentricity in
capturing the effects of irregular
masonry infills**

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Introduction

Masonry infills are often used for the construction of R/C buildings in many countries with high seismicity. The infills are usually neglected in the process of the buildings' analytical modeling.

It is very common to place the infills non-uniformly in order to fulfill functional reasons, something which can lead to significant irregularities. Such irregularities may cause important increase of the seismic vulnerability, or even in some cases disproportionate structural damage or collapse.

EC8 suggests that these irregularities may be taken into consideration by increasing by a factor of 2.0 the accidental eccentricity's effects.

Objective

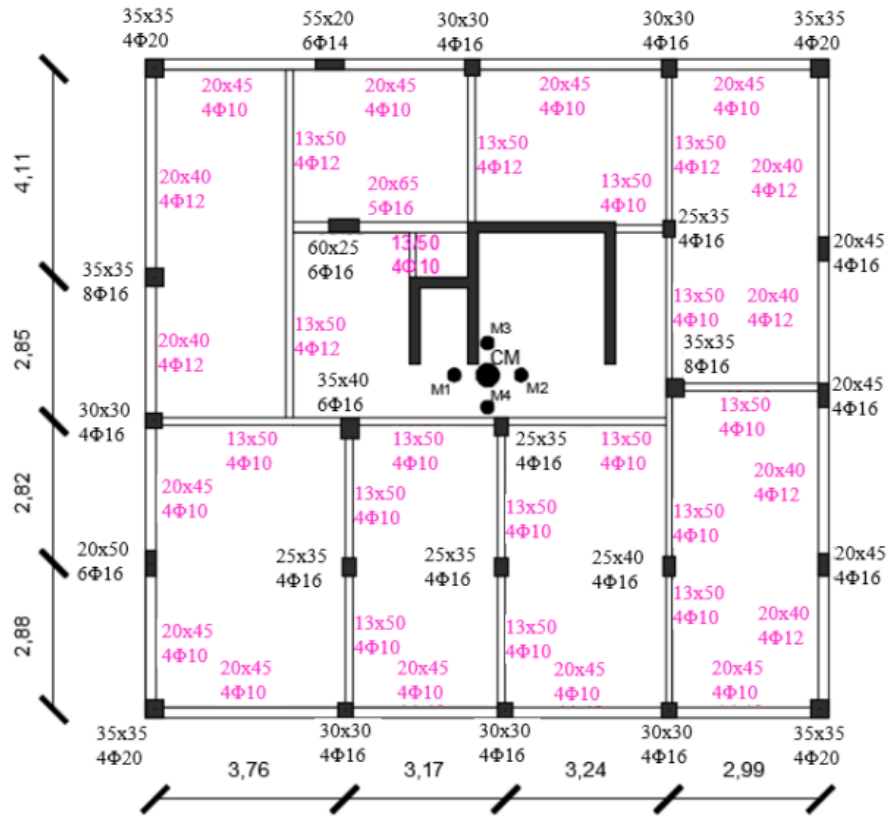
In the present paper the need to increase accidental torsion in nonlinear seismic analyses as a parameter to capture the effects of the infills' irregularities is further investigated through the evaluation of a multi-storey 3D R/C building with irregularly placed masonry infills.

The seismic assessment of the building is carried out using the Nonlinear Pushover Analysis according to the EC8 provisions.

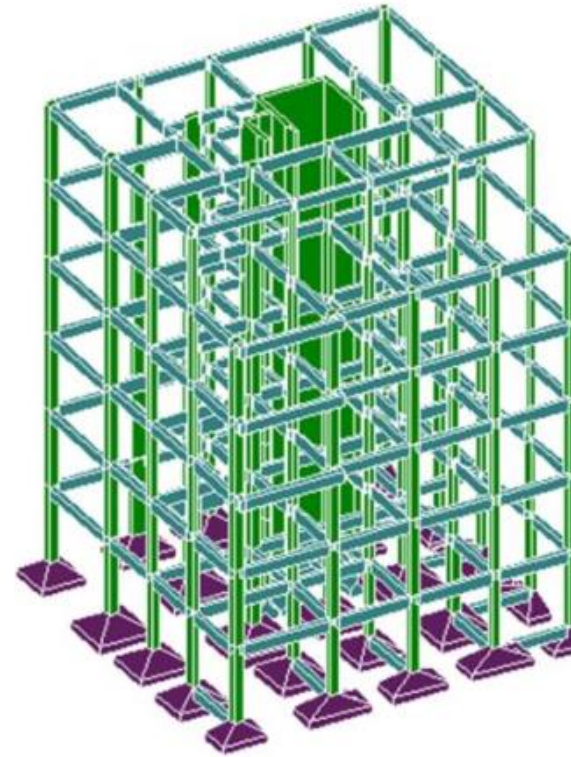
Two different structural models are investigated:

- a) a model taking into account the masonry infills as diagonal struts
- b) a model without taking into account the infills, but increasing by a factor of 2.0 the accidental eccentricity, as EC8 proposes.

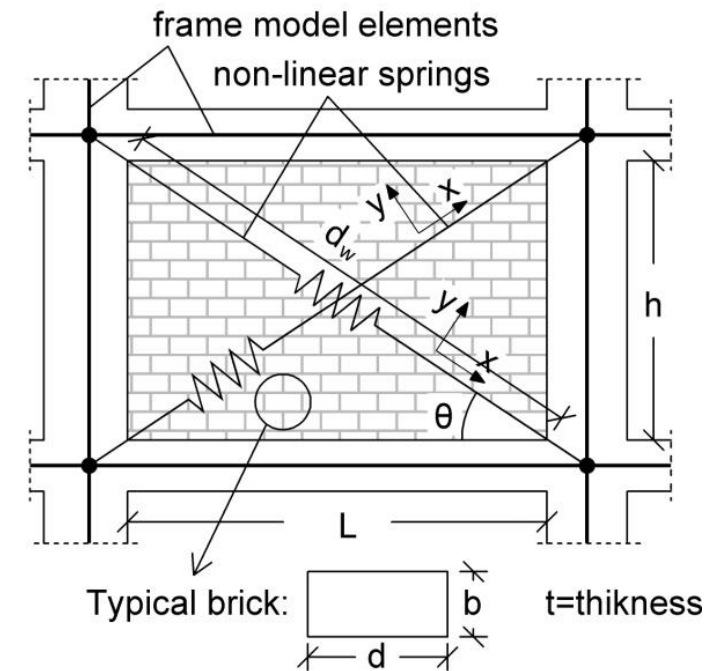
Investigated Building



Concrete: B160
Steel: S220



Plastic hinges at the column and beam ends and at the base of the walls



The properties of the plastic hinges and infills were defined according to EC8 and KAN.EPE.

Analyses

The building was assessed using the Nonlinear Pushover Analysis (NPA) according to the EC8 provisions.

The following different structural models were investigated:

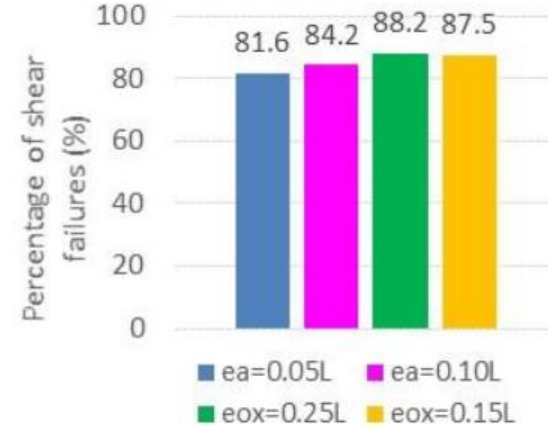
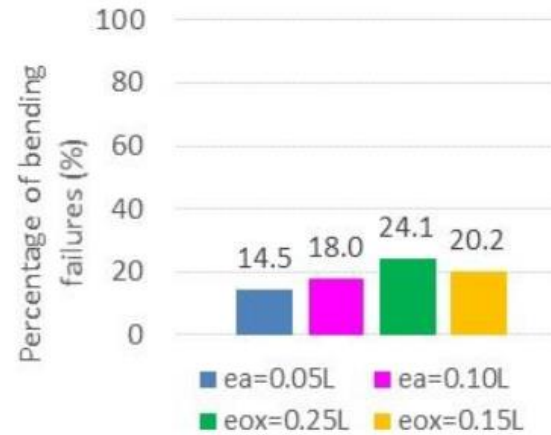
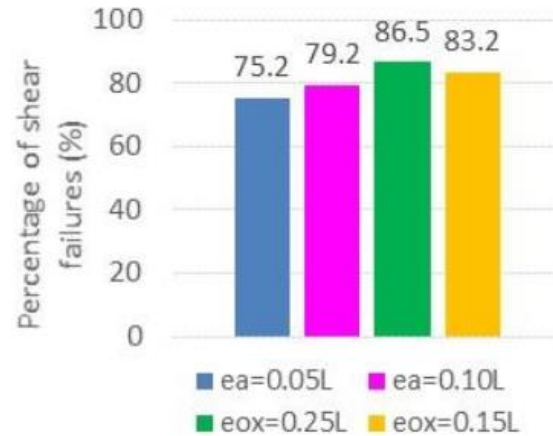
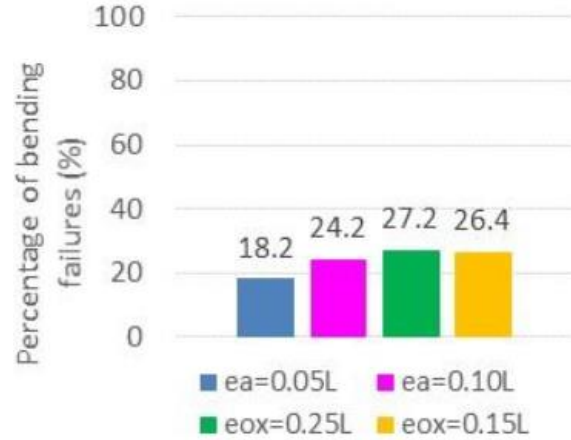
- model without taking into account the infills and using the value of the accidental eccentricity $e_a=0.05L$ proposed by most seismic codes
- model without taking into account the infills, but increasing by a factor of 2.0 the accidental eccentricity ($e_a=0.10L$)
- two models with masonry infills distributed irregularly in-plan in such a way that asymmetry along X-axis is caused
- two models with masonry infills distributed irregularly in-plan in such a way that asymmetry along Y-axis is caused

Analyses

The above structural models were subjected to NPA and all the structural elements of each model were assessed for bending and shear according to the provisions of EC8 (Parts 1 and 3).

- Limit State of Significant Damage
- Knowledge Level of Normal Knowledge
- Horizontal elastic spectrum as defined in EC8-1 for $\alpha_g=0.24g$, viscous damping 5%, ground type C
- Two different lateral load patterns: Uniform and Modal
- Target displacement according to the Annex B of EC8-1
- Assessment of the capacity of each structural element according to the Annex A of EC8-3
- Combination of the effects of the seismic action's components according to the Greek Code of Interventions KAN.EPE.

Results



- Seismic action along Y-axis
- Uniform load pattern
- Mass position M1

- Seismic action along Y-axis
- Modal load pattern
- Mass position M1

Conclusions

In most cases the consideration of the irregularly distributed masonry infills in the structure's modeling leads to larger number of bending and shear failures, however the increase is rather small. Moreover, practically no difference has been noticed between the models with small and large infills' irregularities.

The increase of the accidental eccentricity by a factor of 2.0, as EC8 proposes, leads to more severe damage for the studied building. However, this provision of EC8 was proved to be effective up to a point, since it failed to capture adequately the effects of the irregularities in the infills' distribution for the investigated building.

Thank you for your attention