PUSHOVER ANALYSIS OF R.C. FRAMED STRUCTURES WITH INFILL PANELS MADE OF MASONRY HAVING VARIOUS PROPERTIES

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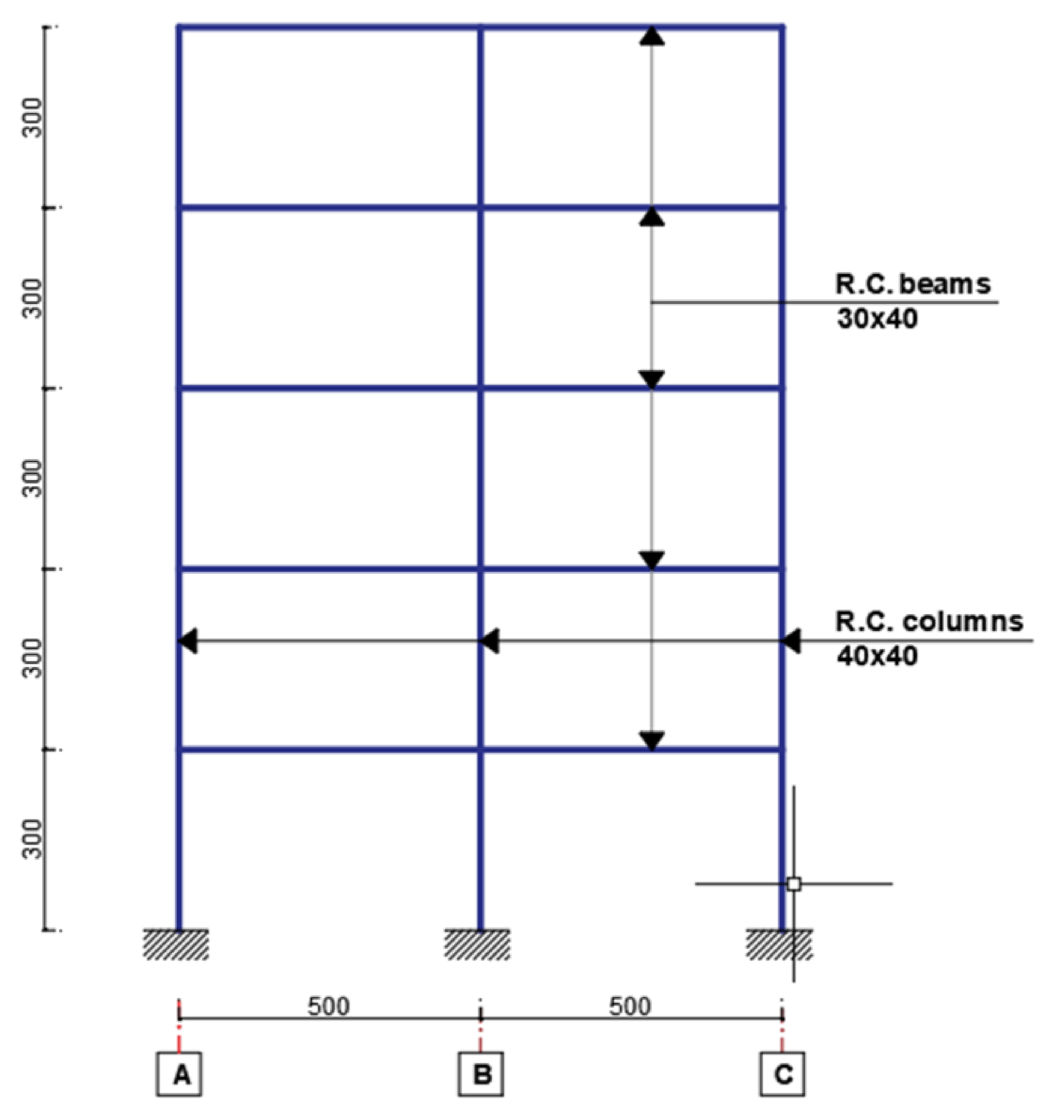
1. ABSTRACT

The seismic performances of R.C. frame structures were determined in terms of inter-storey drifts at two limit states, internal forces and moments (axial forces and bending moments), and the in-plane behavior of infills. A nonlinear static analysis (pushover) was carried out in order to assess the seismic performance of buildings, to identify the expected plastic mechanisms and to plot the capacity curves. In pushover analysis, the vertical distribution of the monotonically increasing horizontal loads, was performed according to the first mode pattern. The nonlinear behavior of structural members for pushover analysis was modelled by using the lumped plasticity, from where it derives that the potential plastic hinges were situated at the beams ends (which yield due to the bending moment), at the top and bottom of the columns at any storey (which yield based on the interaction of axial force and bending moment) and the strut (which yield due to the axial force).

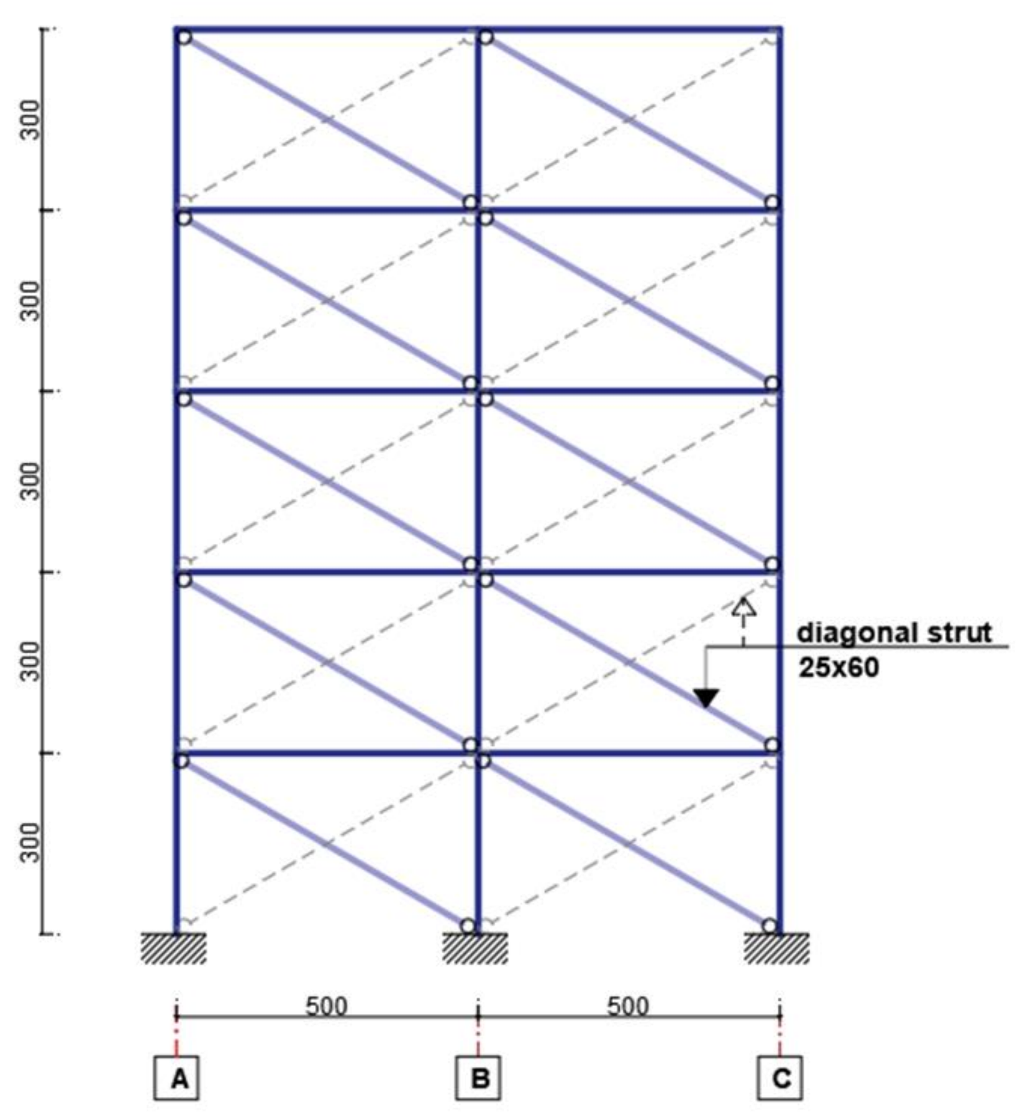
2. MATERIALS AND NUMERICAL SIMULATIONS

2.1 Structures

- ✓ RC frame structures with medium ductility (DCM);
- ✓ Location: Piatra Neamț.



1. RC frame structure (benchmark)



2. RC frame structure with infills

- ✓ Numerical simulations: SAP 2000

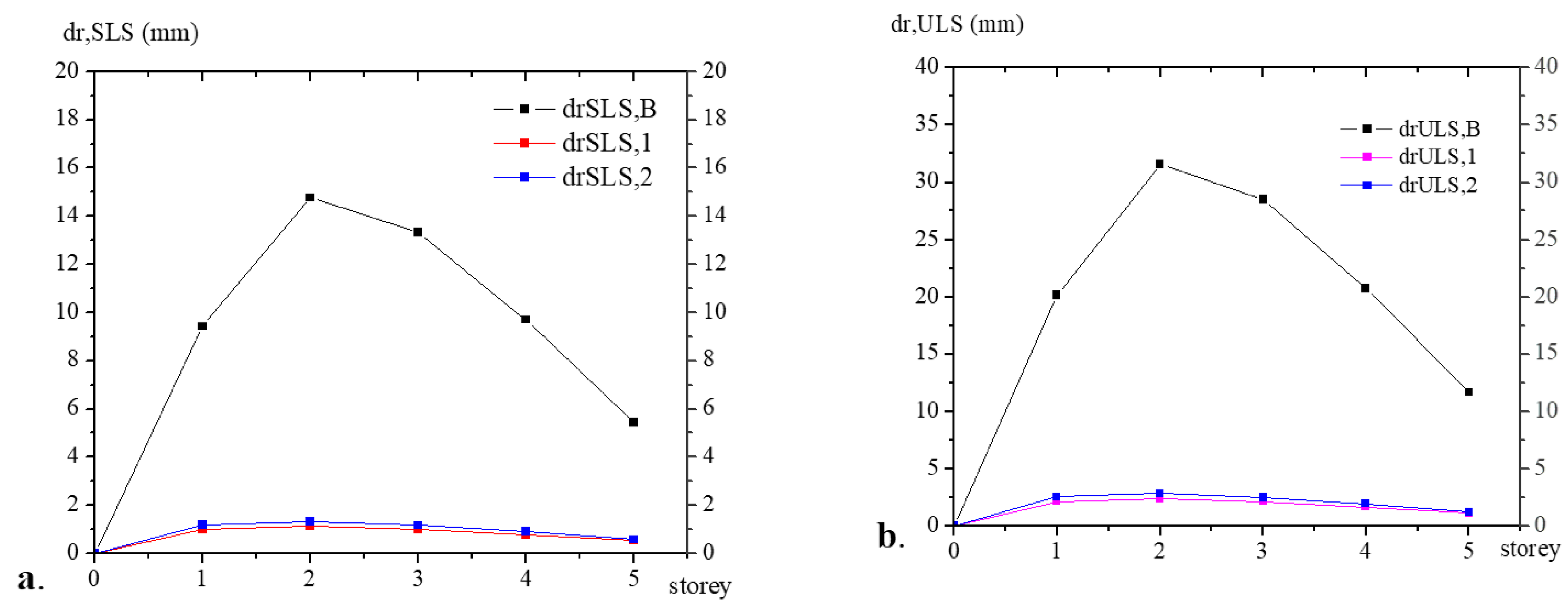
2.2 Materials used for masonry infill panels

1. Mechanical properties of materials used for infill panels

Case study	Frame structure	Mechanical compressive strength [N/mm²]	
		Masonry units	Mortar
1st	bare structure	-	-
2nd	with infills	10N/mm²	5
3rd	with infills	10N/mm²	10

3. RESULTS AND DISCUSSIONS

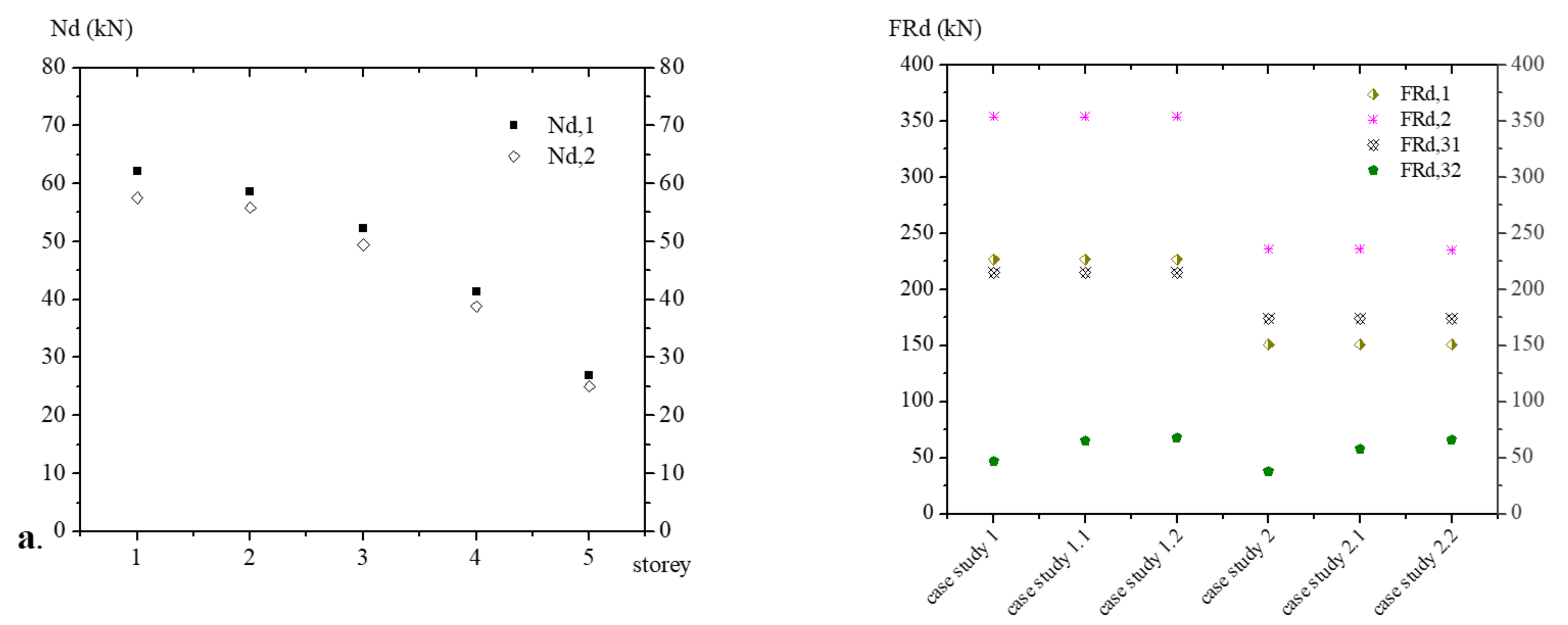
3.1 Inter-strorey drifts



3. Inter-storey drifts of benhmark and infilled structures at SLS (a) and ULS (b)

The inter-storey drifts at SLS and ULS: were diminished by up to 89%-93% (2nd case study) and up to 87%-91% (3rd case study), compared with benchmark.

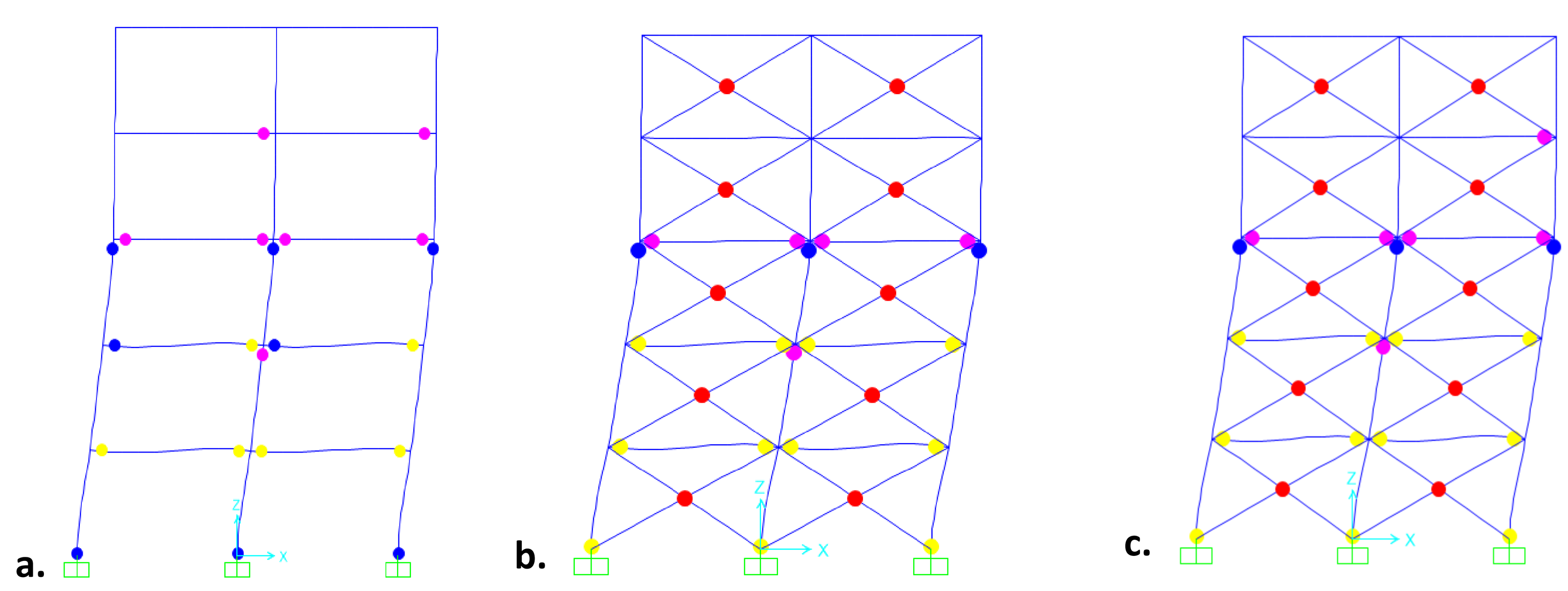
3.2 In-plane performance of infills



4. Axial force in diagonal strut (a) and infills capable forces (b)

To avoid the failure of infills by crushing of corners, three panels with improved mechanical properties have been proposed (case studies 1.2; 2.1; 2.2).

3.3 Pushover



5. Plastic hinge configuration at collapse mechanism of 1st (a); 2nd (b), 3rd case study

2. The seismic performance at SLS and ULS:

Limit states	Seismic performance	
	worst	best
ULS	Case study 2	Case studies 1.1, 2.2
SLS	Case study 2	Case study 2.2

4. CONCLUSIONS

Seismic response of the buildings is influenced by the material properties (units and mortars) and masonry type (with normal or thin bed joints).

References:

[1] Indicativ P100/1-2013, Cod de proiectare seismică - Partea I - Prevederi de proiectare pentru clădiri.

[2] SR EN 1992-1-1, Eurocode 2: Proiectarea structurilor de beton. Partea 1-1: Reguli generale şi reguli pentru clădiri.

[3] Indicativ CR6-2013. Cod de proiectare pentru structuri din zidărie.