Bauhaus-Universität Weimar
Bauhaus Summer School 2025 – NextGen Engineers

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Seismic Resilience in Structural Design: Advanced Methods and Applications

1. Case study

In this study, four RC building typologies (i.e., residential, office, school, and hospital) located in Mexico City are analyzed under rock subsoil conditions.

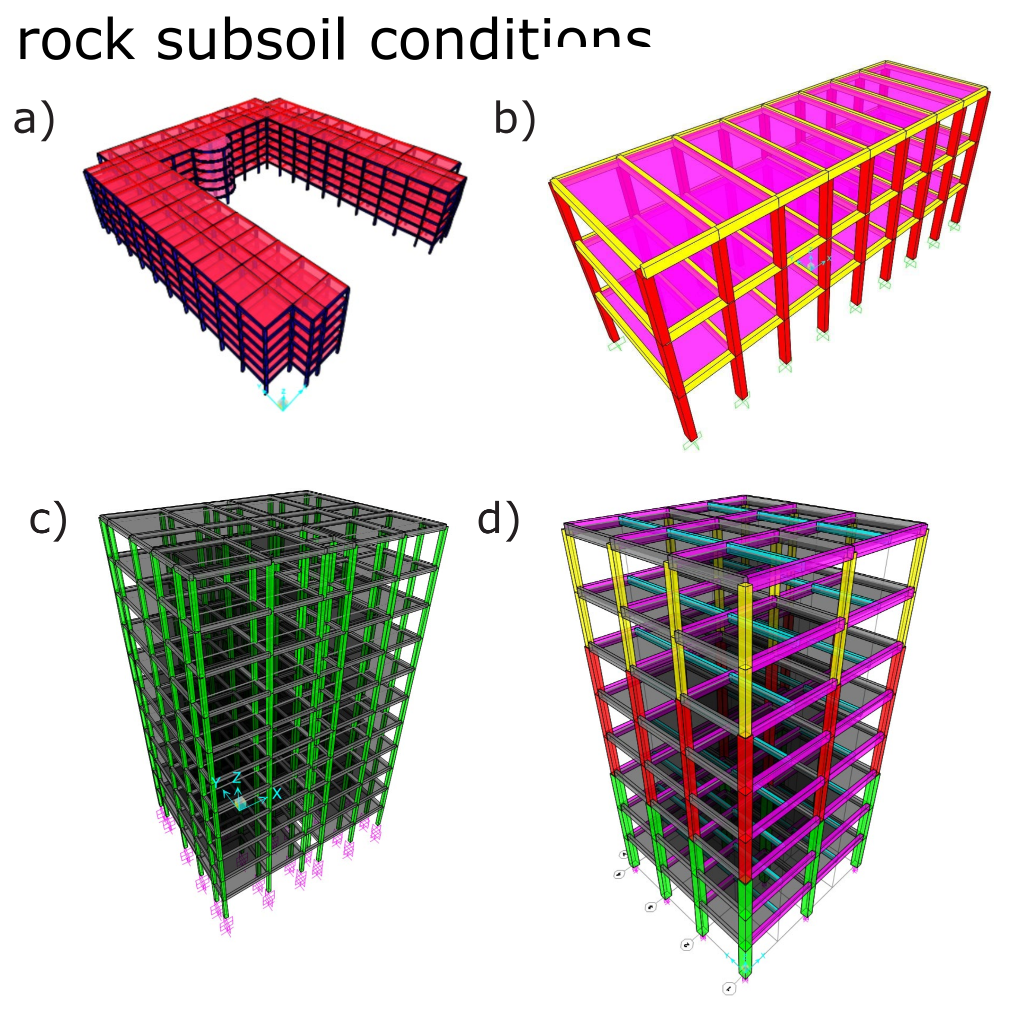


Fig. 1 (a) Hospital; (b) School; (c) Residential; (d) Office.

2. Methodology

Each building is analyzed with and without infill walls (modelled as struts), using base isolation as the retrofit strategy. The models are developed in SAP2000, and nonlinear transient time-history analyses are performed. The structural performance is evaluated by comparing response before and after retrofitting.

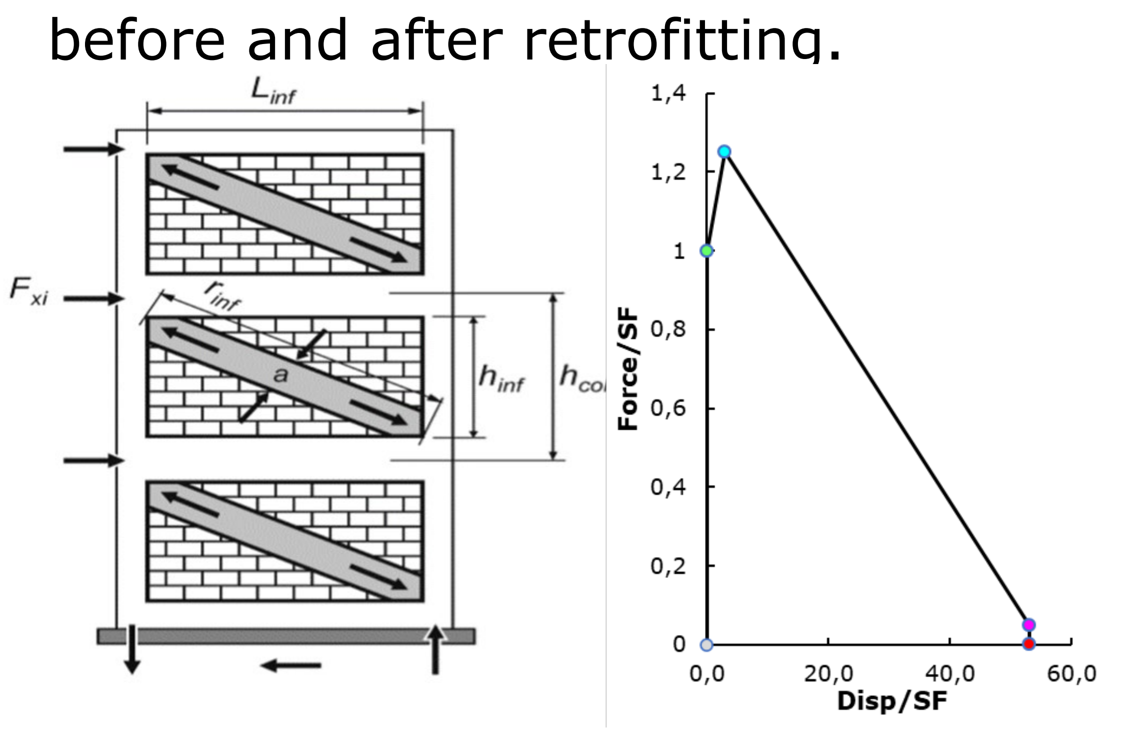


Fig. 2 Infill wall modeling with strut (left) and plastic hinge definition for struts normalized wrt yielding/cracking (right).

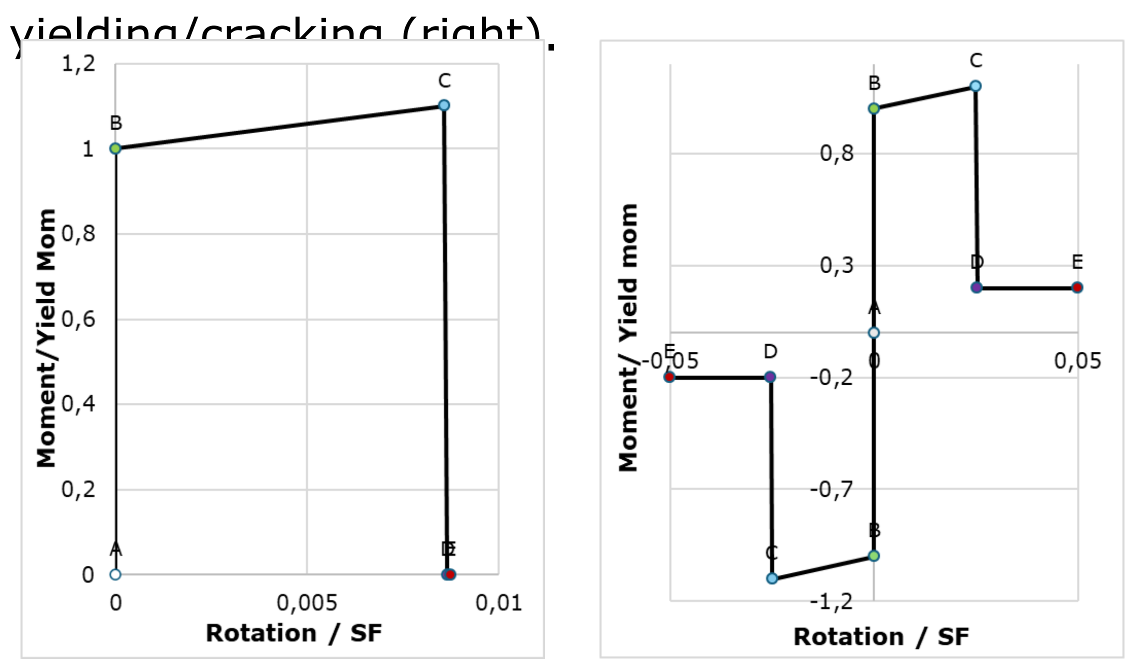
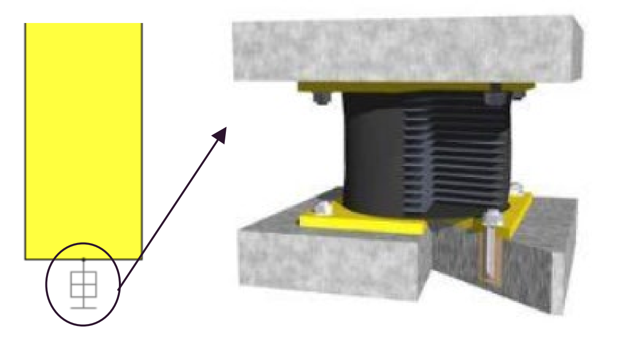


Fig. 3 Plastic hinge definition for columns (left) and beams (right).



Kh	1230	kN/m
Fy	114	kN
α	10%	-

Fig. 4 Seismic isolators location (left) and design parameters for the hospital model with infill walls as example (right)

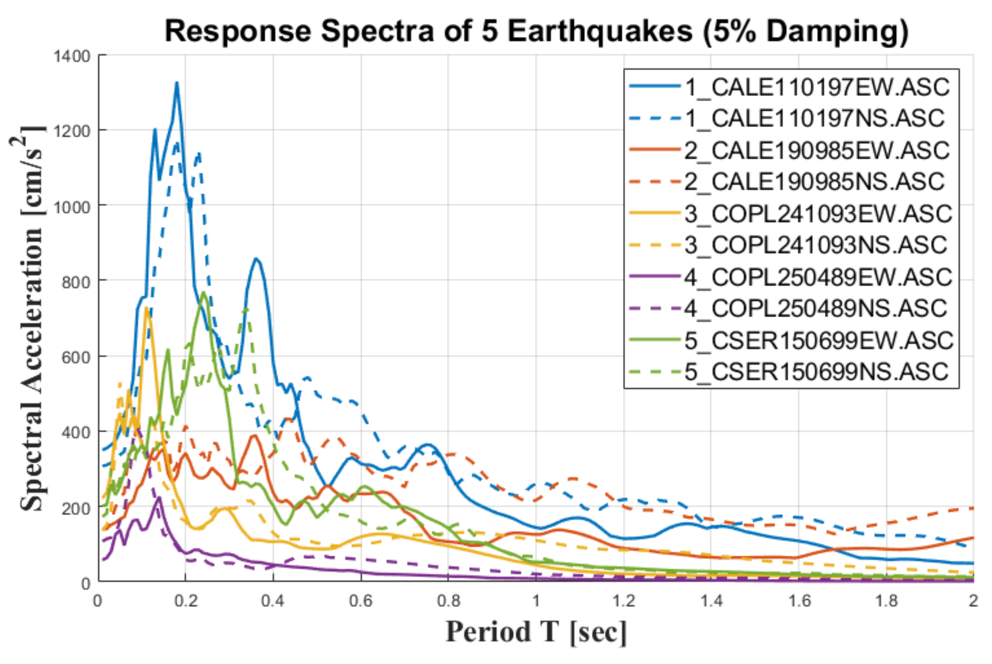


Fig. 5 Response spectra of the considered earthquakes records (5% damping).

3. Results

Interstory drifts, peak floor accelerations, and resilience are evaluated for four building types.

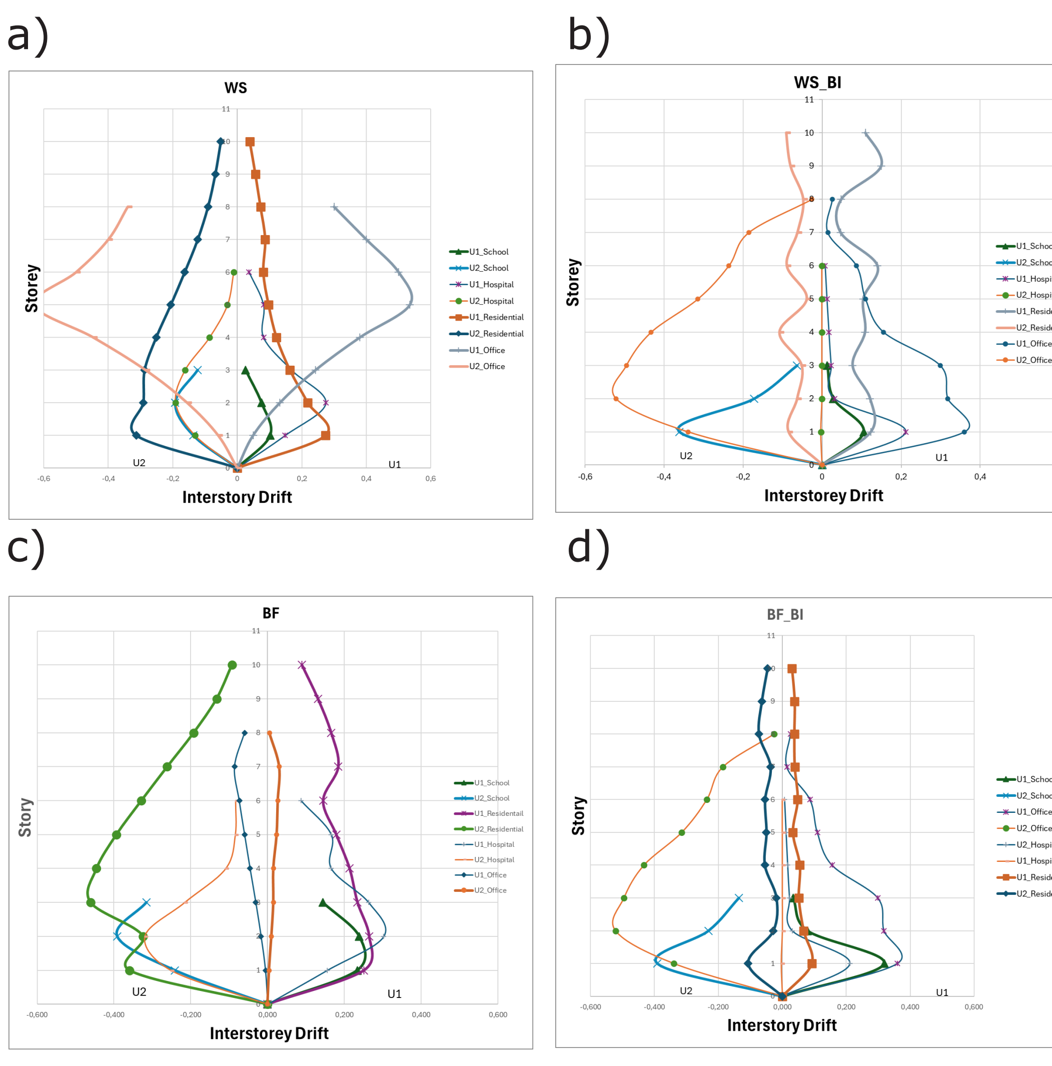


Fig. 6 Inter-story drifts a) WS; b) WS_BI; c) BF; d) BF_BI.

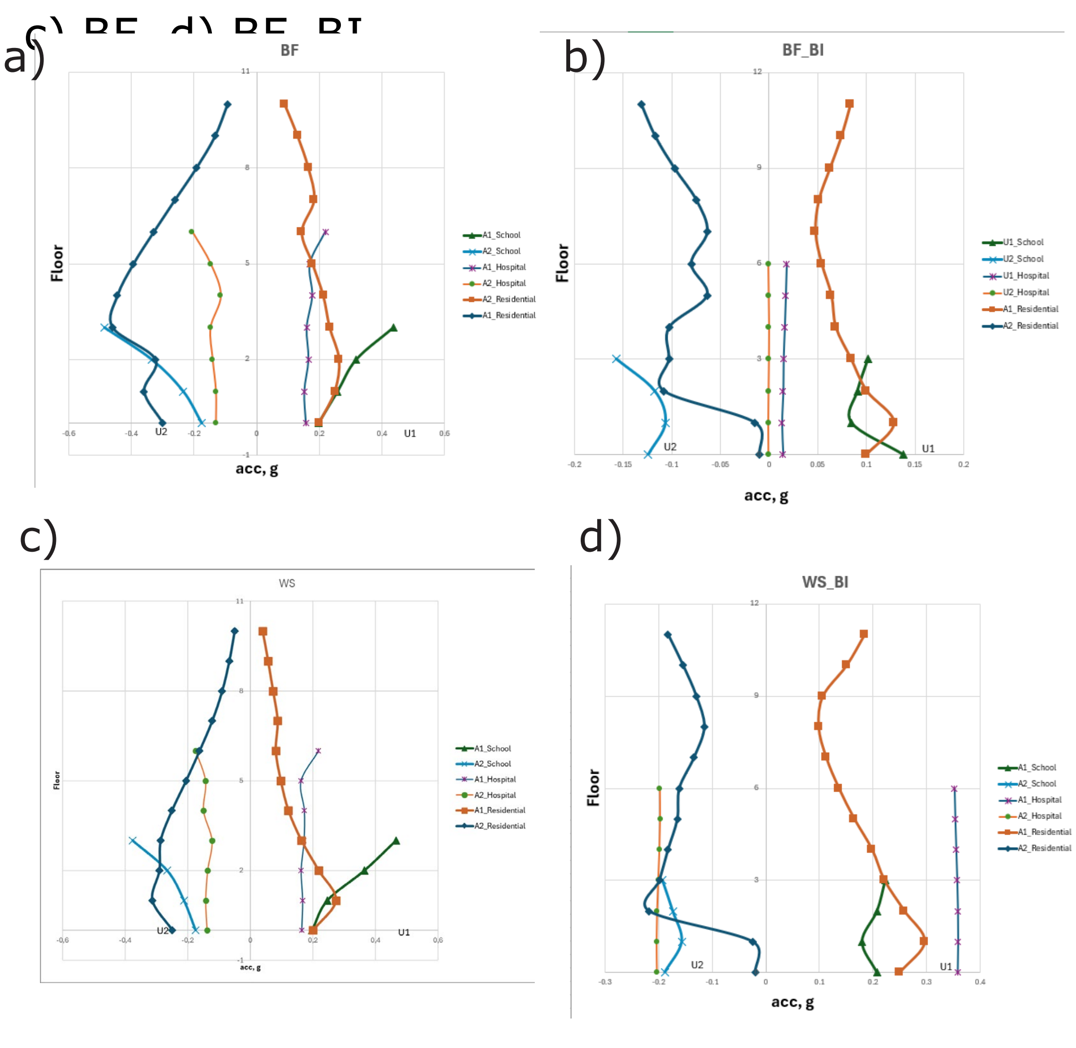


Fig. 7 Acceleration a) BF; b) BF_BI; c) WS, d) WS_BI.

Structural resilience is evaluated on the basis of damaged non-structural components, inter-story drift, peak floor acceleration per story and plastic rotations for the structural elements.

For this case of scenario, there were taken the lowest values of resilience for each building according to the results of the simulation, interpolation and calculus.

School	WS_BI	0.773
Office		0.845
Residentia		0.6
Hospiital		0.907

Fig. 8 Resilience values for each building

4. Conclusions

The purpose of the course was accomplished by obtaining resilience, acceleration and interstory drift per floor; for each building by gathering all the simulation results obtained by all four teams.

The Nonlinear analysis made for these required not only theoretical knowledge, but also TI knowledge and software skills, what at the beginning was challenging.

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