NUMERICAL MODELLING AND FRAGILITY ASSESSMENT OF PRE-CODE RESIDENTIAL BUILDING TYPOLOGIES

BEATRIZ ZAPICO-BLANCO[*], MIGUEL PELLICER GARCÍA[*] AND TIAGO MIGUEL FERREIRA[†]

[*] Universidad de Sevilla
Reina Mercedes, 2, 41012 Sevilla, Spain
bzapico@us.es and URL

[†] Instituto Superior Técnico, University of Lisbon
Av. Rovisco Pais, 1, 1049-001 Lisbon, Portugal
tiago.miguel.ferreira@tecnico.ulisboa.pt and URL

ABSTRACT

Pre-code residential buildings constitute a large share of the built environment across many European regions, particularly in areas that experienced significant urban expansion between the 1950s and the late 1970s. These structures, typically lacking modern seismic design provisions, are characterised by highly repetitive architectural and structural typologies, limited ductility, and construction details that do not align with current performance-based standards. As a result, they present a specific set of vulnerabilities that can be efficiently addressed through typology-driven assessment methodologies.

This thematic session aims to bring together recent contributions on the seismic assessment, modelling, and mitigation of pre-code residential buildings through typology-based frameworks. The session focuses on approaches that integrate structural, geotechnical, and urban-scale information to support efficient and computationally grounded evaluation methods, with a view towards informing decision-making for large housing stocks. Core topics or interest include: (i) definition and refinement of typological classes based on structural and architectural features; (ii) use of cadastral, GIS and remote-sensing data for spatial inventories; (iii) soil-structure interaction modelling and the influence of soft soils on the seismic response of typified buildings; (iv) nonlinear numerical methods, including time-history analysis, incremental dynamic analysis, and fragility curves derivation; (v) reduced-order models (ROMs) and surrogate approaches for large-scale vulnerability estimations; and (vi) integration of probabilistic methods and Bayesian updating for uncertainty quantification.

Special attention is given to moderate-seismicity regions, where risk is often underestimated and where pre-code residential buildings are still in use, frequently by socially vulnerable populations. By framing the problem through typology, the session seeks to promote computationally efficient, reproducible, and generalisable modelling strategies applicable at scale. The primary objective is to bridge high-fidelity numerical modelling with urban risk mitigation practice, encouraging contributions from researchers, practitioners, and institutions engaged in the structural assessment of large residential stocks.