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Utilizing Fiber-Based Modeling to Explore the Presence of a Soft Storey in Masonry-Infilled Reinforced Concrete Structures

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Abstract : Recent seismic events have underscored the significant influence of masonry infill walls on the resilience of structures. The irregular positioning of these walls exacerbates their adverse effects, resulting in substantial material and human losses. Research and post-earthquake evaluations emphasize the necessity of considering infill walls in both the design and assessment phases. This study delves into the presence of soft stories in reinforced concrete structures with infill walls. Employing an approximate method relying on pushover analysis results, fiber-section-based macro-modeling is utilized to simulate the behavior of infill walls. The findings shed light on the presence of soft first stories, revealing a notable 240% enhancement in resistance for weak column—strong beam-designed frames due to infill walls. Conversely, the effect is more moderate at 38% for strong column—weak beam-designed frames. Interestingly, the uniform distribution of infill walls throughout the structure's height does not influence soft-story emergence in the same seismic zone, irrespective of column-beam strength. In regions with low seismic intensity, infill walls dissipate energy, resulting in consistent seismic behavior regardless of column configuration. Despite column strength, structures with open-ground stories remain vulnerable to soft first-story emergence, underscoring the crucial role of infill walls in reinforced concrete structural design.

Keywords : masonry infill walls, soft Storey, pushover analysis, fiber section, macro-modeling
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