PARAMETRIC STUDY OF SHEAR WALL CONFIGURATION ON SEISMIC PERFORMANCE OF A 5-STORY RC BUILDING IN PADANG USING PUSHOVER ANALYSIS

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ABSTRACT

Indonesia, situated within the Pacific Ring of Fire, faces significant seismic risks, particularly in coastal cities like Padang. Many existing mid-rise Reinforced Concrete (RC) buildings in this region were designed using older codes and may lack adequate lateral stiffness, rendering them vulnerable to structural failure during major earthquakes. While adding shear walls is a proven retrofitting strategy to enhance structural resilience, the effectiveness of this method is highly sensitive to the wall placement relative to the building's inherent geometric irregularities. Therefore, determining the optimal configuration is crucial to ensure both safety and cost-effectiveness.

This study utilizes Nonlinear Static (Pushover) Analysis in SeismoStruct to evaluate the seismic performance of a 5-story RC building. A preliminary modal analysis identified a critical stiffness deficiency in the transverse (X) direction ($T_x > T_y$), which guided the design of three retrofit schemes: Exterior (Model 2), Interior (Model 3), and Hybrid (Model 4) placements. The parametric analysis reveals that the existing structure (Model 1) is vulnerable to torsional instability and fails to meet the Life Safety (LS) performance level.

The results confirm that while all schemes improved global stiffness, Model 2 (Exterior Alignment) emerged as the most effective strategy. It successfully mitigated the collapse risk, satisfied LS criteria in both orthogonal directions, and significantly reduced the torsion effect of the building. In conclusion, specifically for building geometries characterized by a dominant weak axis in the transverse direction, placing shear walls at the exterior perimeter is proven to be the superior solution. This configuration effectively balances the center of rigidity, minimizes torsional effects, and prevents the premature brittle shear failure observed in the interior and hybrid configurations.

Keywords: Shear Wall Configuration, SeismoStruct, Pushover Analysis, Seismic Performance, Reinforced Concrete Building, Padang