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ANALYSIS OF REGULAR AND IRREGULAR BUILDINGS AGAINST EARTHQUAKE FORCES BASED ON SNI 1726:2019

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Abstract

This study analyzes the seismic performance of regular and irregular reinforced-concrete building structures according to the SNI 1726:2019 standard. Four twelve-story models were developed using a special moment-resisting frame system: three irregular structures with a re-entrant-corner configuration and one regular structure, using seismic parameters from the earthquake-prone Tarutung region, North Sumatra. Response-spectrum analysis was performed in ETABS, focusing on base shear, story shear, displacement, torsion, and column reinforcement. Results show that the regular model exhibits a coincident center of mass and center of rigidity, whereas the three irregular models show an eccentricity of 0.01-0.32 m, generating additional torsional moment of up to 3.52 kNm at the base column, compared with almost zero in the regular model. The irregular models with the sharpest re-entrant corner (Model 1) required the largest longitudinal column reinforcement (16D22) with the tightest transverse spacing, while the regular model (Model 4) required comparatively less reinforcement (12D22). All models satisfied the strong-column weak-beam requirement of SNI 2847:2019. These findings confirm that horizontal irregularity increases torsional demand and local reinforcement needs, underscoring the importance of strict compliance with seismic design codes when irregular building configurations are unavoidable.
Keywords: base shear; displacement; irregular building; SNI 1726:2019; Twist

INTRODUCTION

The Tarutung area, located in the Renun segment of the Great Sumatra Fault, is one of the areas with high tectonic activity in North Sumatra and has experienced a magnitude 6.0 Mw earthquake that caused damage to buildings and road infrastructure from mild to severe. This condition confirms that earthquakes are natural disasters that cannot be predicted with exact time and magnitude, so building structures in earthquake-prone areas must be designed to be able to withstand seismic forces that may arise (Ahmed et al., 2016).

The development of construction technology has also encouraged changes in the architectural form of multi-storey buildings. Buildings are no longer always designed with a regular square or rectangular plan, but rather follow the demands of aesthetics and land limitations resulting in irregular configurations. Based on SNI 1726:2019 concerning Earthquake Resilience Planning Procedures for Building and Non-Building Structures, building structures are classified as regular or irregular based on the criteria of horizontal and vertical irregularity of the plan.