

# KINERJA STRUKTUR DAN PROBABILITAS KERUSAKAN BANGUNAN GEDUNG RUANG DOSEN KAMPUS 1 UNIVERSITAS TEKNOLOGI YOGYAKARTA TERHADAP GEMPA

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## ABSTRAK

Daerah Istimewa Yogyakarta merupakan salah satu daerah di Indonesia yang mempunyai tingkat aktivitas gempa tinggi. Menurut sejarah, Yogyakarta sering kali mengalami gempa bumi merusak. Dalam upaya meminimalisir risiko, pemerintah telah memperbaharui dan menerbitkan peraturan terkait dengan struktur bangunan tahan gempa. Gedung Ruang Dosen Kampus 1 Universitas Teknologi Yogyakarta yang dibangun di Jl. Ring Road Utara, Sleman memiliki total 4 lantai dan perlu adanya peraturan yang berkaitan dengan potensi kerusakan akibat gempa. Untuk memperkirakan besar kerusakan gedung akibat gempa bisa dilakukan dengan analisis kinerja seismik pada struktur bangunan menggunakan konsep *performance based seismic design* yang merupakan metode menganalisa pola keruntuhan struktur dengan pendekatan *pushover analysis (nonlinear static pushover analysis)*. Kemudian dapat diperhitungkan probabilitas kerusakan struktur bangunan berdasarkan metode HAZUS MH. Penelitian ini dimulai dengan perhitungan beban mati, beban hidup sesuai SNI 1727-2013 dan beban gempa sesuai SNI 1726-2019, pemodelan struktur dan *pushover analysis* dengan program SAP2000, sehingga diperoleh *capacity curve* dan *performance point* untuk menghitung level kinerja berdasarkan ATC-40. Kemudian nilai *spectral displacement* ( $S_d$ ) yang diperoleh dari *performance point* digunakan untuk analisis probabilitas kerusakan struktur dengan metode HAZUS MH. Kurva kapasitas arah x diperoleh gaya geser dasar maksimum 9606,812 KN dengan *displacement* 0,288024 m, sedangkan arah y gaya geser sebesar 9400,047 KN dengan *displacement* 0,288019 m. Pada *Pushover* arah x, *performance point* terjadi pada nilai *spectral acceleration* ( $S_a$ ) 0,25g dan nilai *spectral displacement* ( $S_d$ ) 0,019 m. Sedangkan arah y, *performance point* terjadi pada nilai *spectral acceleration* ( $S_a$ ) 0,25g dan nilai *spectral displacement* ( $S_d$ ) 0,021 m. Level kinerja struktur berdasarkan ATC-40 pada *pushover* arah x dan y termasuk dalam kategori *Immediate Occupancy* (IO). Apabila terjadi gempa pada arah sumbu x potensi bangunan tidak mengalami kerusakan sama sekali (*no damage*) adalah 83,94%, ringan (*slight*) 14,00%, sedang (*moderate*) 2,046% , berat (*extensive*) 0,0133% dan hampir runtuh (*nearly collapse*) 0,00104%. Sedangkan arah y, potensi tidak mengalami kerusakan sama sekali (*no damage*) yaitu 81,85%, ringan (*slight*) 15,63%, sedang (*moderate*) 2,492%, berat (*extensive*) 0,0182% dan hampir runtuh (*nearly collapse*) 0,00142%. Probabilitas kerusakan struktur baik arah x maupun arah y bangunan akibat gempa didominasi oleh kerusakan tingkat ringan (*slight*).

**Kata kunci:** *Gempa, Pushover, Hazus, Fragility, Probabilitas kerusakan*

# **STRUCTURE PERFORMANCE AND PROBABILITY OF BUILDING DAMAGE TO CAMPUS 1 UNIVERSITY OF TECHNOLOGY BUILDING TO EARTHQUAKE**

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## **ABSTRACT**

*The Special Region of Yogyakarta is one of the areas in Indonesia that has a high level of earthquake activity. Historically, Yogyakarta has often experienced destructive earthquakes. In an effort to minimize risks, the government has updated and issued regulations related to earthquake-resistant building structures. Lecturer Room Building Campus 1 Yogyakarta Technological University which was built on Jl. The North Ring Road, Sleman has a total of 4 floors and there is a need for regulations relating to the potential for earthquake damage. To estimate the amount of damage to buildings caused by earthquakes, seismic performance analysis on building structures uses the concept of performance based seismic design which is a method of analyzing the pattern of structural collapse using a pushover analysis approach (nonlinear static pushover analysis). Then the probability of damage to the building structure can be calculated based on the HAZUS MH method. This research begins with the calculation of dead load, live load according to SNI 1727-2013 and earthquake load according to SNI 1726-2019, structural modeling and pushover analysis with the SAP2000 program, in order to obtain a capacity curve and performance point to calculate the performance level based on ATC-40. Then the spectral displacement (Sd) value obtained from the performance point is used to analyze the probability of structural damage using the HAZUS MH method. The x-direction capacity curve obtained a maximum base shear force of 9606,812 KN with a displacement of 0.288024 m, while the y-direction shear force of 9400,047 KN with a displacement of 0.288019 m. In the x-direction pushover, the performance point occurs at the spectral acceleration (Sa) 0.25g and the spectral displacement (Sd) 0.019 m. In the y direction, the performance point occurs at the spectral acceleration (Sa) 0.25g and the spectral displacement (Sd) 0.021 m. The performance level of the structure based on ATC-40 in the x and y direction pushovers belongs to the Immediate Occupancy (IO) category. If an earthquake occurs in the x-axis direction, the potential for the building to not suffer any damage (no damage) is 83.94%, light (slight) 14.00%, moderate (moderate) 2.046%, severe (extensive) 0.0133% and almost collapse (nearly collapse) 0.00104%. While in the y direction, the potential for no damage at all (no damage) is 81.85%, light (slight) 15.63%, moderate (moderate) 2.492%, severe (extensive) 0.0182% and almost collapse (nearly collapse). ) 0.00142%. The probability of structural damage in both the x and y directions of the building due to the earthquake is dominated by light damage.*

**Keywords:** Earthquake, Pushover, Hazus, Fragility, Probability of damage