ABSTRACT

"EARTHQUAKE FORCE ANALYSIS AND STRUCTURAL PERFORMANCE EVALUATION OF A 25-STORY APARTMENT IN SURABAYA THROUGH COMPARISON OF FEMA 365 AND ASCE 41-17 WITH NON-LINEAR STATIC PUSHOVER METHOD"

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Indonesia is located in the Ring of Fire region which makes it very vulnerable to seismic activity. Surabaya City is included in earthquake risk area due to the presence of two active faults, namely Surabaya Fault and Waru Fault. Therefore, the planning of high-rise buildings in this region must take into account the potential earthquake hazard with the Performance Based Design (PBD) approach, which not only considers earthquake forces, but also deformation and potential structural damage. One of the methods used in this approach is non-linear static pushover analysis. This research aims to evaluate the seismic performance of a 25-story apartment building in Surabaya City using the pushover method with reference to SNI 1726:2019 and FEMA 365 and ASCE 41-17 evaluation standards. This building has experienced vibrations due to the 2024 Bawean earthquake, so further analysis is needed to determine the structure's resistance to lateral loads. The analysis results show that the maximum base shear value in the X direction is 13,705.5172 kN with a lateral displacement of 1.491 mm, while in the Y direction it is 14,017.4469 Kn with a displacement of 1.701 mm. This indicates that the Y direction is the strong axis of the building. Evaluation of the structural performance level based on FEMA 365 shows that the maximum total drift value is still below the Immediate Occupancy (IO) limit. Meanwhile, based on ASCE 41-17, the maximum value of inelastic drift is also within safe limits. Thus, the structure is declared feasible and can be immediately functioned again after the earthquake without experiencing significant damage.

Keywords: Pushover Analysis, Structure Performance, FEMA 365, & ASCE 41-17

ABSTRAK

ANALISIS GAYA GEMPA DAN EVALUASI KINERJA STRUKTUR PADA APARTEMEN 25 LANTAI SURABAYA MELALUI PERBANDINGAN FEMA 365 DAN ASCE 41-17 DENGAN METODE PUSHOVER STATIK NON-LINEAR

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Indonesia terletak pada kawasan Ring of Fire yang menjadikannya sangat rentan terhadap aktivitas seismik. Kota Surabaya termasuk wilayah berisiko gempa akibat keberadaan dua sesar aktif, yakni Sesar Surabaya dan Sesar Waru. Oleh karena itu, perencanaan bangunan bertingkat di wilayah ini harus memperhatikan potensi bahaya gempa bumi dengan pendekatan Performance Based Design (PBD), yang tidak hanya mempertimbangkan gaya gempa, tetapi juga deformasi serta potensi kerusakan struktur. Salah satu metode yang digunakan dalam pendekatan ini adalah analisis pushover statik non-linear. Penelitian ini bertujuan untuk mengevaluasi kinerja seismik bangunan apartemen 25 lantai di Kota Surabaya menggunakan metode pushover dengan acuan SNI 1726:2019 dan standar evaluasi FEMA 365 serta ASCE 41-17. Bangunan ini pernah mengalami getaran akibat gempa Bawean tahun 2024, sehingga diperlukan analisis lanjutan untuk mengetahui ketahanan struktur terhadap beban lateral. Hasil analisis menunjukkan nilai base shear maksimum pada arah X sebesar 13.705,5172 kN dengan perpindahan lateral 1,491 mm, sedangkan pada arah Y sebesar 14.017,4469 kN dengan perpindahan 1,701 mm. Ini mengindikasikan bahwa arah Y merupakan sumbu kuat bangunan. Evaluasi tingkat kinerja struktur berdasarkan FEMA 365 menunjukkan nilai drift total maksimum masih di bawah batas Immediate Occupancy (IO). Sementara itu, berdasarkan ASCE 41-17, nilai maksimum inelastik drift juga masih dalam batas aman. Dengan demikian, struktur dinyatakan layak dan dapat langsung difungsikan kembali pascagempa tanpa mengalami kerusakan berarti.

Kata Kunci: Analisis Pushover, Kinerja Struktur, FEMA 365, dan ASCE 41-17