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Evaluasi Kinerja Komponen Struktural Gedung Pendidikan 7 Lantai Berdasarkan Standar ASCE 41-23
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INTISARI

Indonesia merupakan wilayah dengan aktivitas seismik tinggi sehingga bangunan publik seperti fasilitas pendidikan memiliki kerentanan besar terhadap kerusakan akibat gempa. Kondisi tersebut dapat mengganggu keselamatan pengguna serta keberlangsungan kegiatan akademik pascabencana. Oleh karena itu, evaluasi kinerja struktur bangunan eksisting perlu dilakukan dengan tujuan untuk memastikan komponen struktur masih memenuhi target tingkat kinerja pada level bahaya gempa yang ditinjau.

Penelitian ini dilakukan pada gedung pendidikan 7 lantai di Kota Yogyakarta yang termasuk kategori risiko IV dengan mengacu pada prosedur ASCE 41-23. Evaluasi dilakukan terhadap target kinerja *Immediate Occupancy* (IO) pada tingkat bahaya seismik BSE-1E dengan gempa kala ulang 225 tahun dan *Life Safety* (LS) pada tingkat bahaya seismik BSE-2E dengan gempa kala ulang 975 tahun. Prosedur evaluasi dilakukan dalam dua tahapan, yaitu *Tier* 1 (*screening*) dan *Tier* 2 (*deficiency-based evaluation*). Tahap *Tier* 1 mencakup pemeriksaan *quick check* dan *checklist* untuk mendeteksi potensi defisiensi awal pada struktur. Selanjutnya, evaluasi *Tier* 2 dilakukan menggunakan *linear dynamic procedure* (LDP) berbasis analisis riwayat waktu melalui pemodelan menggunakan ETABS.

Hasil evaluasi menunjukkan bahwa pada *Tier* 1 terdapat beberapa parameter yang tidak memenuhi persyaratan, terutama pada tegangan geser kolom, rasio simpangan antar lantai, serta beberapa persyaratan pada *checklist* sehingga evaluasi dilanjutkan pada *Tier* 2. Berdasarkan hasil evaluasi lanjutan, seluruh balok representatif memenuhi kriteria kegagalan lentur dan beberapa balok tidak memenuhi kegagalan geser, terutama S1 untuk tingkat kinerja *Immediate Occupancy* dan *Life Safety* serta B1 dan B5 untuk tingkat kinerja *Life Safety*. Sementara itu, hampir seluruh tipe kolom tidak memenuhi kriteria aksial lentur untuk tingkat kinerja *Immediate Occupancy* dan *Life Safety*, sedangkan pada kegagalan geser, elemen K6 dan K7 tidak memenuhi tingkat kinerja *Immediate Occupancy* dan *Life Safety* serta K1a, K2, dan K9 tidak memenuhi tingkat kinerja *Life Safety*. Secara keseluruhan, gedung pendidikan 7 lantai tidak memenuhi target tingkat kinerja *Immediate Occupancy* dan *Life Safety*.

Kata kunci: evaluasi, ASCE 41-23, gedung pendidikan, *immediate occupancy*, *life safety*

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ABSTRACT

Indonesia is a region with high seismic activity therefore public buildings such as educational facilities are highly vulnerable to damage due to earthquakes. These conditions can interfere with user safety and the sustainability of academic activities after a disaster. Therefore, the structural performance evaluation of existing buildings needs to be conducted to ensure that the structural components still satisfy the target performance level under the considered seismic hazard level.

This study was conducted on a 7-story educational building in Yogyakarta City which is included in risk category IV with reference to the ASCE 41-23 procedure. The evaluation was performed for the Immediate Occupancy (IO) performance target at the BSE-1E seismic hazard level, corresponding to a 225-year return period earthquake, and the Life Safety (LS) performance target at the BSE-2E seismic hazard level, corresponding to a 975-year return period earthquake. The evaluation procedure was carried out in two stages, namely Tier 1 (screening) and Tier 2 (deficiency-based evaluation). The Tier 1 stage included quick checks and checklist examinations to detect potential initial structural deficiencies. Subsequently, the Tier 2 evaluation was performed using the linear dynamic procedure (LDP) based on time history analysis through ETABS modeling.

The evaluation results indicate that, in Tier 1, several parameters did not satisfy the requirements, especially in the column shear stress, drift ratio, and several checklist requirements therefore the evaluation was continued to Tier 2. Based on the advanced evaluation results, all representative beams satisfied the flexural failure criteria, while several beams did not satisfy the shear failure criteria, particularly S1 for both the Immediate Occupancy and Life Safety performance levels, as well as B1 and B5 for the Life Safety performance level. Meanwhile, almost all column types did not satisfy the axial-flexural criteria for both the Immediate Occupancy and Life Safety performance levels. In terms of shear failure, elements K6 and K7 did not satisfy the Immediate Occupancy and Life Safety performance levels, while K1a, K2, and K9 did not satisfy the Life Safety performance level. Overall, the 7-story educational building does not satisfy the target performance levels of Immediate Occupancy and Life Safety.

Keywords: *evaluation, ASCE 41-23, educational building, immediate occupancy, life safety*