

INTISARI

Sektor konstruksi menghasilkan emisi karbon sebesar 39% dari CO₂ global tahunan dunia, baik dari operasi, proses konstruksi, dan material bangunan. Kayu rekayasa menjadi alternatif material konstruksi yang berkelanjutan dalam mengurangi dampak pemanasan global akibat emisi karbon. Salah satu bentuk kayu rekayasa adalah Glulam (*Glued Laminated Timber*). Glulam terdiri dari lamina-lamina kayu yang direkatkan disertai dengan proses penekanan atau pengempaan sehingga tercapai homogenitas dan kepadatan yang lebih tinggi. Pemanfaatan kayu rekayasa dalam pembangunan gedung bertingkat sendiri belum dapat ditemukan di Indonesia.

Dalam Tugas Akhir ini, perancangan rumah susun 7 tingkat dengan rangka Glulam GL28h mengadopsi denah lantai “Asrama Ratnaningsih Kinanthi 1” di Yogyakarta. Fokus perancangan pada elemen balok, kolom, pelat lantai, dan sambungan dianalisis menggunakan perangkat lunak Dlubal RFEM. Dimensi elemen struktur hasil perancangan ulang didapatkan dengan proses iterasi hingga mencapai rasio kapasitas mendekati dan tidak lebih dari 1. Sedangkan, sambungan balok-kolom ditinjau pada 3 *joint* kritis berdasarkan *output* gaya dalam terbesar. Basis pemodelan dan analisis struktur mengacu pada standar Eurocode 5 untuk verifikasi performa struktur dan elemen perancangan seperti sistem sambungan baut. Pembebanan pada struktur mengikuti EN 1990:2002, EN 1991:2002, SNI 1726:2019, dan SNI 1727:2020, dengan beban-beban yang dikenakan berupa beban mati, beban hidup, beban angin, dan beban gempa.

Hasil perancangan menunjukkan elemen kolom (500x500 mm) dan balok (300x360 mm, 300x400 mm, 300x460 mm, dan 300x480 mm) optimal dalam menahan beban aksial tarik, tekan, geser, torsi, dan lentur. Sambungan balok-kolom yang ditinjau juga mampu memberi daya dukung dan menahan gaya geser yang terjadi. Selain itu, simpangan antar lantai pada Rumah Susun Glulam 7 Lantai diprediksi dengan hasil baik dan tidak melebihi batasan simpangan izin (2% tinggi antar tingkat). Berdasarkan hasil simulasi dan evaluasi, bangunan Rumah Susun Glulam 7 Lantai termasuk dalam kategori *Immediate Occupancy (IO) to Life Safety (LS)* dimana struktur mampu menahan beban gempa dengan sedikit kerusakan struktural.

Kata kunci: Analisis Elemen Hingga, Dlubal RFEM, Eurocode 5, Glulam, Rumah Susun.

ABSTRACT

The construction sector releases 39% of the world's global CO₂ emission, both from building operation, construction, and material. Engineered wood can be a sustainable alternative material of choice to face global warming impact. One form of engineered wood is Glulam (Glued Laminated Timber). Glulam consists of laminated woods which are glued and pressed together increasing the homogeneity and density strength of wood significantly. The utilization of engineering wood in the construction of multi-storey buildings cannot be found in Indonesia yet.

In this final project, the design of the 7-storey residential building which uses Glulam GL28h open frame adopts the floor plan of "Asrama Ratnaningsih Kinanthi 1" in Yogyakarta. The design focus on beam, column, floor, and connection elements was analyzed using using Dlubal RFEM software. The dimensions of redesigned structural elements are obtained by an iterative process until the capacity ratio close and not exceeding 1. Meanwhile, the connection is reviewed at 3 critical joints based on maximum internal forces. To determine the structural performance and design components as well as connection system, the design of the residential building is in accordance with Eurocode 5 while the loading configuration follows EN 1990:2002, EN 1991:2002, SNI 1726:2019, and SNI 1727:2020, which are dead load, live load, wind load, and seismic load.

The design results show that the column (500x500 mm) and beam (300x360 mm, 300x400 mm, 300x460 mm, and 300x480 mm) elements are optimal in axial tension, compression, shear, torsion, and bending capacity. The connections are also capable of providing load-carrying capacity and withstand the shear force that occurs. In addition, the inter-story drift of the 7-storey Glulam residential building is predicted to be fine and does not exceed the allowed inter-story drift limit (2% height). Based on the simulation and evaluation, the 7-storey Glulam flat is categorized in the Immediate Occupancy (IO) to Life Safety (LS) category, where the structure is able to withstand seismic load and the structure is less damaged.

Keywords: *Finite Element Analysis, Dlubal RFEM, Eurocode 5, Glulam, Residential Housing.*