Analisis Desain Struktur Tower Laboratorium Menggunakan Metode Analisis Gempa Respon Spektrum dan Riwayat Waktu Linear dengan Integrasi Building Information Modeling (BIM) = Structural Design Analysis of Laboratory Tower Using Response Spectrum and Linear Time History Analysis Methods with Building Information Modeling (BIM) Integration

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Abstrak

Laboratorium sebagai prasarana pembelajaran di perguruan tinggi harus dipastikan memiliki desain struktur yang kuat menahan beban dan tahan terhadap gempa. Integrasi model struktur dengan BIM akan mempermudah perencanaan struktur. Penelitian dilakukan pada struktur tower laboratorium Departemen Teknik Sipil Universitas Indonesia 12 tingkat yang memiliki ketidakberaturan horizontal dan vertikal. Analisis desain struktur dilakukan berdasarkan metode respon spektrum dan riwayat waktu linear yang mengacu SNI 1726:2019 dan SNI 2847:2019 menggunakan software Midas Gen. Didapatkan pada respon struktur tower laboratorium DTS UI, story drift arah X dan story shear dengan metode riwayat waktu linear memberikan respon lebih besar, dan sebaliknya terhadap story drift arah Y dan story displacement. Gaya dalam komponen struktur yang dihasilkan dengan metode respon spektrum lebih besar dibandingkan metode riwayat waktu linear, sehingga dari hasil iterasi desain, dimensi penampang struktur dan kebutuhan tulangan didapatkan lebih besar. Penerapan Building Information Modeling (BIM) dalam integrasi software Midas Gen dengan Revit memiliki kelebihan dalam proses perhitungan volume material beton elemen struktur, namun memiliki keterbatasan pada transfer properti material, tulangan, dan pendefinisian pelat serta orientasi penampang dan struktur yang tidak sesuai. Terdapat perbedaan volume material beton yang didapatkan dari perhitungan manual dengan Revit sebesar 0.032% pada kolom dan 0.97% pada balok dengan hasil perhitungan volume lebih besar didapatkan dengan perhitungan manual.

.....Laboratory as learning infrastructure in universities must be ensured to have a strong structural design to support loads and resistant to earthquakes. Integrating the structural model with BIM will simplify structural planning. Research was conducted on a 12 story laboratory tower structure at the Department of Civil Engineering, University of Indonesia, which has horizontal and vertical irregularities. Structural design analysis was carried out based on spectrum response and linear time history method referring to SNI 1726:2019 and SNI 2847:2019 using Midas Gen software. The response of the DTS UI laboratory tower structure showed that story drift in the X-direction and story shear using the linear time history method provided a larger response, whereas conversely, towards the Y-direction story drift and story displacement, the response spectrum method showed a larger response. Forces within the structural components generated using the response spectrum method were greater than the linear time history method, resulting in larger cross-sectional dimensions and reinforcement requirements obtained from design iterations. The implementation of Building Information Modeling (BIM) in integrating Midas Gen software with Revit has advantages in calculating the volume of concrete material in structural elements, but has limitations in the transfer of material properties, reinforcement, and plate definition as well as inappropriate orientation of cross-sections and structures. There is a difference in the volume of concrete material obtained from manual

calculations with Revit of 0.032% for columns and 0.97% for beams with larger volume calculation results obtained using manual calculations.