ANALISIS STRUKTUR PORTAL BETON BERTULANG DENGAN SISTEM *TUNED MASS DAMPER* AKIBAT BEBAN LATERAL DINAMIK

Fanesa[1], Yusep Ramdani[2], Herianto[3]

Jurusan Teknik Sipil, Fakultas Teknik, Universitas Siliwangi

Jalan Siliwangi No. 24 Tasikmalaya, Jawa Barat, Indonesia

Email: fanessiregar@gmail.com

ABSTRAK

Berdasarkan letak geografisnya, Indonesia memiliki tingkat aktivitas seismik tinggi sehingga struktur bangunan memerlukan sistem tambahan untuk meningkatkan kinerja dinamiknya, salah satunya *Tuned Mass Damper* (TMD). Penelitian ini menganalisis pengaruh penerapan TMD terhadap respons seismik struktur portal beton bertulang akibat beban lateral dinamik. Studi kasus dilakukan pada gedung perkantoran sepuluh lantai di Kota Tasikmalaya dengan dimensi 18 m × 24 m dan tinggi 35 m. TMD dimodelkan pada lantai teratas menggunakan ETABS sebagai *link/support properties* dan *additional mass* dengan variasi rasio massa 1% hingga 10% dan 20%. Analisis dilakukan menggunakan metode dinamik *linear time history* dengan tiga rekaman gempa, yaitu Tottori, Iwate, dan Tohoku. Hasil menunjukkan bahwa penambahan rasio massa TMD memperpanjang periode alami struktur dan menurunkan frekuensi alami secara linier. Pada gempa Tottori dan Iwate, peningkatan rasio massa menghasilkan penurunan *displacement* dan simpangan antar tingkat yang relatif konsisten. Namun, pada gempa Tohoku, efektivitas TMD tidak meningkat secara monoton, melainkan menunjukkan adanya rasio massa optimum. Gaya geser dasar juga mengalami penurunan yang sejalan dengan penurunan *displacement* dan simpangan antar tingkat, yang mengindikasikan reduksi gaya inersia akibat transfer energi getar ke TMD. Rasio massa rentang 7%–10% memberikan kinerja peredaman paling optimal dan stabil terhadap berbagai karakteristik gempa. Penelitian ini menyimpulkan bahwa variasi rasio massa dan karakteristik gempa menjadi faktor penting dalam perancangan TMD guna menjamin keamanan struktur terhadap beban seismik.

Kata Kunci: Beton Bertulang, *Linear Time History,* Respon Dinamik, *Tuned Mass Damper,* Variasi Rasio Massa

ANALYSIS OF REINFORCED CONCRETE FRAME STRUCTURE WITH TUNED MASS DAMPER SYSTEM SUBJECTED TO DYNAMIC LATERAL LOADS

Fanesa[1], Yusep Ramdani[2], Herianto[3]

Department of Civil Engineering, Falculty of Engineering, Siliwangi University

Siliwangi St No. 24 Tasikmalaya, *West Java*, Indonesia

ABSTRACT

Based on its geographical location, Indonesia has a high level of seismic activity, requiring building structures to have additional systems to improve their dynamic performance, one of which is a Tuned Mass Damper (TMD). This study analyzes the effect of applying TMD on the seismic response of reinforced concrete portal structures due to dynamic lateral loads. A case study was conducted on a ten-story office building in Tasikmalaya City with dimensions of 18 m × 24 m and a height of 35 m. The TMD was modeled on the top floor using ETABS as link/support and additional mass properties with mass ratios varying from 1% to 10% and 20%. The analysis was performed using the linear dynamic time history method with three earthquake records, namely Tottori, Iwate, and Tohoku. The results showed that increasing the TMD mass ratio prolonged the natural period of the structure and decreased the natural frequency linearly. In the Tottori and Iwate earthquakes, an increase in the mass ratio resulted in a relatively consistent decrease in displacement and inter-story drift. However, in the Tohoku earthquake, the effectiveness of TMD did not increase monotonically but showed an optimum mass ratio. The base shear force also decreased in line with the decrease in displacement and inter-story drift, indicating a reduction in inertial force due to the transfer of vibrational energy to the TMD. A mass ratio about 7%–10% provided the most optimal and stable damping performance for various earthquake characteristics. This study concluded that variations in the mass ratio.

Keyword: *Reinforced Concrete, Linear Time History, Dynamic Response, Tuned Mass Damper, Mass Ratio Variation*