INTISARI

Beberapa kejadian gempa besar menyebabkan *wharf* mengalami kerusakan sehingga tidak bisa beroperasi. Di lain sisi, torsi tak terduga masih jarang diperhitungkan untuk analisis *wharf* walaupun sudah dipersyaratkan dalam tata cara perencanaan ketahanan gempa untuk bangunan. Penelitian ini bertujuan untuk mengetahui kinerja seismik dan perilaku torsional struktur *wharf* melalui parameter *displacement* dan regangan.

Penelitian ini mengevaluasi kinerja seismik *wharf* yang terletak di sebuah PLTU di Provinsi Sulawesi Utara. Variasi model berjumlah 60 buah yang terdiri dari variasi *offset* eksentrisitas beban lateral pushover sebesar -5%, 0%, dan 5% sebagai representasi torsi tak terduga, variasi titik kontrol *displacement* (1 pusat massa dan 4 titik pada tiap sudut denah *wharf*), variasi kala ulang gempa (475 dan 2475 tahun), serta variasi arah beban lateral pushover pada kedua sumbu orthogonal utama. Kedalaman titik jepit ekuivalen tiang digunakan untuk analisis panjang penjepitan tiang sebagai representasi *soil-structure interaction*. Analisis *target displacement* struktur dilakukan dengan mencari nilai *target displacement* sesuai dengan prosedur pada FEMA-356. Kriteria penerimaan berupa *strain limit* pada komponen beton, baja tulangan, dan pipa baja sesuai ASCE 61-14 digunakan untuk evaluasi kinerja seismik *wharf*.

Hasil penelitian yang didapatkan yaitu akibat gempa dengan kala ulang 475 tahun menunjukkan bahwa struktur masih berada pada kinerja *controlled and repairable damage*, dan akibat gempa dengan kala ulang 2475 tahun struktur masih berada pada kinerja *life safety protection*. Torsi inheren dimiliki struktur berdasarkan hasil analisis variasi titik kontrol *displacement*. Pengaplikasian *offset* eksentrisitas beban lateral, pengaplikasian peningkatan beban gempa, dan pengaplikasian variasi arah pembebanan pushover terbukti memberikan efek peningkatan *displacement* dan regangan yang terjadi pada komponen sendi plastis.

Kata Kunci: *wharf*, analisis pushover, torsi tak-terduga, arah pembebaban, sendi plastis

ABSTRACT

Several major earthquakes have damaged wharf and caused it to become inoperable. On the other hand, accidental torsion is still not commonly taken into account for wharf analysis even though it is required in the seismic resistance design procedures for buildings. This study aims to determine the seismic performance and torsional behavior of the wharf structure through displacement and strain parameters.

This study evaluates the seismic performance of a wharf located at a Coal-Fired Steam Power Plant (PLTU) in North Sulawesi Province. There were 60 model variations consisting of -5%, 0%, and 5% offset of pushover lateral load eccentricity to represent accidental torsion, displacement control point variations (1 center of mass and 4 points at each corner of the wharf plan), earthquake return period variations (475 and 2475 years), and pushover lateral load direction variations on both main orthogonal axes. The equivalent fixity depth of the pile is used to analyze the fixity length of pile as a representation of the soil-structure interaction. The target displacement analysis of the structure was performed by finding the target displacement value according to the procedure in FEMA-356. Acceptance criteria in the form of strain limits on concrete components, reinforcing steel, and steel pipes according to ASCE 61-14 were used for evaluation of the seismic performance of the wharf.

The results obtained are due to an earthquake with a return period of 475 years, indicating that the structure is still in the performance of controlled and repairable damage, and due to an earthquake with a return period of 2475 years, the structure is still in the performance of life safety protection. The inherent torsion owned by the structure is based on the results of the displacement control point variation analysis. The application of lateral load eccentricity offset, application of increasing earthquake loads, and application of variations in the direction of pushover loading are proven to have the effect of increasing displacement and strain that occurs in plastic hinge components.

Keywords: wharf, pushover analysis, accidental torsion, load direction, plastic hinge