

DAFTAR ISI

| | |
|--|-------------------------------------|
| Halaman Judul | i |
| Halaman Pengesahan | ii |
| PERNYATAAN BEBAS PLAGIASI | iii |
| KATA PENGANTAR | iv |
| DAFTAR ISI | v |
| DAFTAR TABEL | viii |
| DAFTAR GAMBAR | x |
| ABSTRAK | Error! Bookmark not defined. |
| <i>ABSTRACT</i> | Error! Bookmark not defined. |
| BAB I PENDAHULUAN | Error! Bookmark not defined. |
| 1.1. Latar Belakang | Error! Bookmark not defined. |
| 1.2. Rumusan Masalah | Error! Bookmark not defined. |
| 1.3. Tujuan Penelitian | Error! Bookmark not defined. |
| 1.4. Batasan Penelitian | Error! Bookmark not defined. |
| 1.5. Manfaat Penelitian | Error! Bookmark not defined. |
| BAB II STUDI PUSTAKA | Error! Bookmark not defined. |
| 2.1. Penelitian Terdahulu | Error! Bookmark not defined. |
| 2.1.1. Analisis Kerapuhan Seismik Struktur Beton Bertulang | Error! Bookmark not defined. |
| 2.1.2. Pembentukan Kurva Kerapuhan Berbasis Analisis Pushover Untuk Evaluasi Kinerja Seismik Jembatan Beton | Error! Bookmark not defined. |
| 2.1.3. Evaluasi Kinerja Struktur Gedung Fakultas Teknik Sipil dan Perencanaan “M.Natsir” UII Yogyakarta | Error! Bookmark not defined. |
| 2.2. Perbedaan Substansi Penelitian | Error! Bookmark not defined. |
| BAB III LANDASAN TEORI | Error! Bookmark not defined. |
| 3.1. Filosofi Bangunan Tahan Gempa | Error! Bookmark not defined. |
| 3.2. Ketentuan Umum Pada Perencanaan Ketahanan Gempa Untuk Struktur Bangunan Gedung Berdasarkan SNI 03-1726-2012 | Error! Bookmark not defined. |

| | |
|--|-------------------------------------|
| 3.2.1. Penentuan Gempa Rencana dan Kategori Gedung | Error! Bookmark not defined. |
| 3.2.2. Spektrum Respons Desain | Error! Bookmark not defined. |
| 3.2.3. Kategori Desain Seismik | Error! Bookmark not defined. |
| 3.3. Analisis Respons Struktur | Error! Bookmark not defined. |
| 3.3.1. Sendi Plastis | Error! Bookmark not defined. |
| 3.4. Analisis Statik Linier | Error! Bookmark not defined. |
| 3.5. Analisis <i>Pushover</i> | Error! Bookmark not defined. |
| 3.6. Kurva Kerapuhan Bangunan | Error! Bookmark not defined. |
| 3.6.1. Bahaya Gempa dan Efek Respons Situs | Error! Bookmark not defined. |
| 3.6.2. Kondisi Kerusakan Bangunan | Error! Bookmark not defined. |
| 3.6.3. Respon Bangunan | Error! Bookmark not defined. |
| 3.6.4. Kurva Kerapuhan Seismik Bangunan | Error! Bookmark not defined. |
| 3.6.5. Analisis Kurva Kerapuhan Seismik | Error! Bookmark not defined. |
| BAB IV METODE PENELITIAN | Error! Bookmark not defined. |
| 4.1. Lokasi Penelitian | Error! Bookmark not defined. |
| 4.2. Prosedur Penelitian | Error! Bookmark not defined. |
| 4.3. Data Teknis Penelitian | Error! Bookmark not defined. |
| 4.4. Metode Analisis Data | Error! Bookmark not defined. |
| 4.4.1. Pengumpulan Data | Error! Bookmark not defined. |
| 4.4.2. Pemodelan Numerik Struktur | Error! Bookmark not defined. |
| 4.4.3. Pembebanan Gempa | Error! Bookmark not defined. |
| 4.4.4. Analisis Data | Error! Bookmark not defined. |
| 4.5. Jadwal Penelitian | Error! Bookmark not defined. |
| BAB V ANALISIS DAN PEMBAHASAN | Error! Bookmark not defined. |
| 5.1. Pemodelan Struktur | Error! Bookmark not defined. |
| 5.2. Pembebanan Struktur | Error! Bookmark not defined. |
| 5.2.1. Beban Mati | Error! Bookmark not defined. |
| 5.2.2. Beban Hidup | Error! Bookmark not defined. |
| 5.2.3. Beban Gempa SNI 03-1726-2012 | Error! Bookmark not defined. |

| | |
|---|-------------------------------------|
| 5.3. Analisis statik linier | Error! Bookmark not defined. |
| 5.3.1. Rasio Simpangan Tingkat (<i>Storey-drift ratio</i>) | Error! Bookmark not defined. |
| 5.3.2. <i>Demand Capacity Ratio</i> (DCR) | Error! Bookmark not defined. |
| 5.4. Analisis <i>Pushover</i> | Error! Bookmark not defined. |
| 5.4.1. Pendefenisian Sendi Plastis | Error! Bookmark not defined. |
| 5.4.2. Pembebanan Analisis <i>Pushover</i> di SAP 2000 | Error! Bookmark not defined. |
| 5.4.3. Hasil Analisis Statik Nonlinear (<i>Pushover</i>) | Error! Bookmark not defined. |
| 5.4.4. Pembahasan Hasil Analisis Statik Nonlinear (<i>Pushover</i>) | Error! Bookmark not defined. |
| 5.5. Analisis Kerapuhan Seismik | Error! Bookmark not defined. |
| 5.5.1. Parameter Kurva Kerapuhan | Error! Bookmark not defined. |
| 5.5.2. Hasil Analisis Kerapuhan Seismik | Error! Bookmark not defined. |
| 5.5.3. Pembahasan Hasil Analisis Kerapuhan Seismik | Error! Bookmark not defined. |
| BAB VI KESIMPULAN DAN SARAN | Error! Bookmark not defined. |
| 6.1. Kesimpulan | Error! Bookmark not defined. |
| 6.2. Saran | Error! Bookmark not defined. |
| DAFTAR PUSTAKA | Error! Bookmark not defined. |
| LAMPIRAN | Error! Bookmark not defined. |
| LAMPIRAN 1 | |
| LAMPIRAN 2 | |
| LAMPIRAN 3 | |

DAFTAR TABEL

- Tabel 2. 1 Perbedaan substansi penelitian terdahulu dengan penelitian saat ini
Error! Bookmark not defined.
- Tabel 3. 1 Kategori risiko bangunan gedung dan non gedung untuk beban **Error!
Bookmark not defined.**
- Tabel 3. 2 Faktor keutamaan gempa **Error! Bookmark not defined.**
- Tabel 3. 3 Koefisien situs F_a **Error! Bookmark not defined.**
- Tabel 3. 4 Koefisien situs F_v **Error! Bookmark not defined.**
- Tabel 3. 5 Kategori desain seismik berdasarkan parameter respons percepatan
pada perioda pendek (SDS) **Error! Bookmark not defined.**
- Tabel 3. 6 Kategori desain seismik berdasarkan parameter respons percepatan
pada perioda 1 detik **Error! Bookmark not defined.**
- Tabel 3. 7 Nilai parameter perioda pendekatan C_t dan α **Error! Bookmark not
defined.**
- Tabel 3. 8 Tipe struktur bangunan **Error! Bookmark not defined.**
- Tabel 3. 9 *Building Structural Fragility (High-Code Seismik Design Level)* **Error!
Bookmark not defined.**

| | |
|--|-------------------------------------|
| Tabel 4. 1 Dimensi dan detail penulangan pelat | Error! Bookmark not defined. |
| Tabel 4. 2 Dimensi dan detail penulangan balok | Error! Bookmark not defined. |
| Tabel 4. 3 Dimensi dan detail penulangan kolom | Error! Bookmark not defined. |
| Tabel 4. 4 <i>Time schedule</i> | Error! Bookmark not defined. |
| Tabel 5. 1 Reaksi perletakan joint untuk berat sendiri kuda-kuda | Error! Bookmark not defined. |
| Tabel 5. 2 Beban dinding | Error! Bookmark not defined. |
| Tabel 5. 3 Berat bangunan perlantai | Error! Bookmark not defined. |
| Tabel 5. 4 Parameter desain spektra | Error! Bookmark not defined. |
| Tabel 5. 5 Perhitungan distribusi gaya horizontal gempa SNI 1726-2012 | Error! Bookmark not defined. |
| Tabel 5. 6 Titik pusat massa tiap lantai | Error! Bookmark not defined. |
| Tabel 5. 7 Nilai <i>storey-drift ratio</i> pada masing masing tingkat | Error! Bookmark not defined. |
| Tabel 5. 8 Data kurva kapasitas arah x Gedung Kuliah <i>Twin Building</i> UMY | Error! Bookmark not defined. |
| Tabel 5. 9 Data kurva kapasitas arah y Gedung Kuliah <i>Twin Building</i> UMY | Error! Bookmark not defined. |
| Tabel 5. 10 Data spektrum kapasitas arah x Gedung Kuliah <i>Twin Building</i> UMY | Error! Bookmark not defined. |
| Tabel 5. 11 Data spektrum kapasitas arah y Gedung Kuliah <i>Twin Building</i> UMY | Error! Bookmark not defined. |
| Tabel 5. 12 Tipe struktur bangunan dalam HAZUS | Error! Bookmark not defined. |
| Tabel 5. 13 <i>Building structural fragility (High-code seismic design level)</i> | Error! Bookmark not defined. |
| Tabel 5. 14 Nilai S_d dan β_{ds} untuk berbagai jenis kerusakan pada struktur Gedung Kuliah <i>Twin Building</i> UMY | Error! Bookmark not defined. |

Tabel 5. 15 Hasil perhitungan propabilitas kerusakan struktur untuk berbagai kategori *damage state* pada struktur Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**

Tabel 5. 16 Nilai probabilitas pada berbagai kondisi kerusakan Gedung Kuliah *Twin Building* UMY bedasarkan percepatan tanah maksimum daerah Yogyakarta **Error! Bookmark not defined.**

DAFTAR GAMBAR

- Gambar 1. 1** Gedung fasilitas pendidikan yang runtuh akibat gempa Yogyakarta tahun 2006 **Error! Bookmark not defined.**
- Gambar 1. 2** Tampak depan Gedung Kuliah Twin Building UMY **Error! Bookmark not defined.**
- Gambar 3. 1** SS, gempa maksimum yang dipertimbangkan risiko-tertarget (MCER) **Error! Bookmark not defined.**
- Gambar 3. 2** S1, gempa maksimum yang dipertimbangkan risiko-tertarget (MCER) **Error! Bookmark not defined.**
- Gambar 3. 3** Spektrum respons desain **Error! Bookmark not defined.**
- Gambar 3. 4** Respon struktur akibat gempa **Error! Bookmark not defined.**
- Gambar 3. 5** Posisi sumbu lokal balok struktur pada program SAP 2000 **Error! Bookmark not defined.**
- Gambar 3. 6** Posisi sumbu lokal kolom struktur pada program SAP 2000 **Error! Bookmark not defined.**
- Gambar 3. 7** Sendi plastis yang terjadi pada balok dan kolom **Error! Bookmark not defined.**
- Gambar 3. 8** Ilustrasi *Pushover* dan *Capacity Curve* **Error! Bookmark not defined.**
- Gambar 3. 9** Contoh faktor modal partisipasi (MPF) dan koefisien massa (α) **Error! Bookmark not defined.**
- Gambar 3. 10** Proses konversi kurva kapasitas ke bentuk *capacity curve spectrum* **Error! Bookmark not defined.**
- Gambar 3. 11** Perubahan format respons spectra menjadi ADRS **Error! Bookmark not defined.**
- Gambar 3. 12** Metodologi estimasi kerugian gempa HAZUS untuk bangunan **Error! Bookmark not defined.**

- Gambar 3. 13** *Capacity spectrum* dan letak dari titik kunci **Error! Bookmark not defined.**
- Gambar 3. 14** Kurva kerapuhan bangunan **Error! Bookmark not defined.**
- Gambar 4. 1** Lokasi penelitian **Error! Bookmark not defined.**
- Gambar 4. 2** Denah lantai 1 Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**
- Gambar 4. 3** Potongan A Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**
- Gambar 4. 4** Tahapan analisis kerapuhan seismik **Error! Bookmark not defined.**
- Gambar 4. 5** Tahapan analisis kerapuhan seismik (lanjutan) **Error! Bookmark not defined.**
- Gambar 5. 1** 1 Pemodelan *open frame* 3D struktur Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**
- Gambar 5. 2** Koefisien angin **Error! Bookmark not defined.**
- Gambar 5. 3** Pemodelan struktur kuda-kuda 3D **Error! Bookmark not defined.**
- Gambar 5. 4** *Material property data* **Error! Bookmark not defined.**
- Gambar 5. 5** *Frame properties* **Error! Bookmark not defined.**
- Gambar 5. 6** *Joint restraints* **Error! Bookmark not defined.**
- Gambar 5. 7** *Define load patterns* **Error! Bookmark not defined.**
- Gambar 5. 8** *Joint forces* **Error! Bookmark not defined.**
- Gambar 5. 9** *Frame releases* **Error! Bookmark not defined.**
- Gambar 5. 10** *Frame* setelah di *release* **Error! Bookmark not defined.**
- Gambar 5. 11** *Steel frame design* berdasarkan AISC-LRFD93 **Error! Bookmark not defined.**
- Gambar 5. 12** *Set load cases to run* **Error! Bookmark not defined.**
- Gambar 5. 13** Desain spektra Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**

- Gambar 5. 14** Hasil perhitungan desain spektra gedung *Twin Building* UMY **Error! Bookmark not defined.**
- Gambar 5. 15** *Define Mass Source* **Error! Bookmark not defined.**
- Gambar 5. 16** *Load Case Data – Modal* **Error! Bookmark not defined.**
- Gambar 5. 17** Hasil analisis modal **Error! Bookmark not defined.**
- Gambar 5. 18** Letak titik pusat massa dan arah beban lateral lantai 2 **Error! Bookmark not defined.**
- Gambar 5. 19** *Displacement* pada masing-masing tingkat **Error! Bookmark not defined.**
- Gambar 5. 20** *Storey-drift ratio* pada masing-masing tingkat **Error! Bookmark not defined.**
- Gambar 5. 21** Detail bentangan arah x dan arah y **Error! Bookmark not defined.**
- Gambar 5. 22** Nilai DCR gaya geser pada beberapa balok lantai 1 **Error! Bookmark not defined.**
- Gambar 5. 23** Pendefinisian *hinge* pada balok **Error! Bookmark not defined.**
- Gambar 5. 24** *Hinge property* pada balok **Error! Bookmark not defined.**
- Gambar 5. 25** *Moment rotation data* kolom **Error! Bookmark not defined.**
- Gambar 5. 26** *P-M2-M3 Interaction surface* pada kolom **Error! Bookmark not defined.**
- Gambar 5. 27** *Load case data* **Error! Bookmark not defined.**
- Gambar 5. 28** *Nonlinear parameters* beban gravitasi **Error! Bookmark not defined.**
- Gambar 5. 29** *Nonlinear parameters* beban lateral **Error! Bookmark not defined.**
- Gambar 5. 30** Kurva kapasitas arah x Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**
- Gambar 5. 31** Kurva kapasitas arah y Gedung Kuliah *Twin Building* UMY **Error! Bookmark not defined.**

Gambar 5. 32 Hasil analisis *hinge properties* Kolom tangga lantai 3 **Error!**
Bookmark not defined.

Gambar 5. 33 Hasil analisis *hinge properties* Kolom K7-DASAR-1 **Error!**
Bookmark not defined.

Gambar 5. 34 Letak titik *median spectral displacement* kondisi kerusakan *moderate, extensive, dan complete* pada skala log **Error! Bookmark not defined.**

Gambar 5. 35 Kurva kerapuhan arah x Gedung Kuliah *Twin Building* UMY
Error! Bookmark not defined.

Gambar 5. 36 Kurva kerapuhan arah y Gedung Kuliah *Twin Building* UMY
Error! Bookmark not defined.