

REDESAIN STRUKTUR DAN ANALISIS *DIRECT DISPLACEMENT BASED DESIGN (DDBD)*

PADA GEDUNG BNI DR CIPTO SEMARANG

Muhammad Isa Sulaiman

INTISARI

Wilayah di Indonesia merupakan wilayah yang rawan terjadi gempa bumi karena dilewati oleh lempeng Eurasia dan lempeng Indo-Australia. Perencanaan bangunan tahan gempa perlu dilakukan untuk meminimalisir pengaruh gaya gempa bumi. Saat ini salah satu konsep untuk perencanaan bangunan tahan gempa adalah Perencanaan Berbasis Kinerja (*Performance Based Design*) dengan metode beban dorong statik atau analisis *pushover*. Analisis *pushover* mampu memberikan informasi pola keruntuhan ketika bangunan terbebani dengan gaya gempa sehingga tingkat kinerja bangunan bisa diketahui. Tingkat kinerja dapat dinilai berdasarkan ATC-40 dan FEMA-440.

Tujuan dari penulisan tugas akhir ini adalah melakukan redesain komponen struktur dengan sistem rangka momen khusus (SRMK) dan mengetahui kinerja struktur dengan analisis *pushover* terhadap tahanan gempa sesuai ATC-40 dan FEMA-440, dengan kategori kinerja *Operational*, *Immediate Occupancy*, *Life Safety*, *Collapse Prevention*. Pada analisa ini ditinjau gedung perkantoran 6 lantai dengan lokasi gempa di Semarang. Analisis dilakukan dengan bantuan *software* ETABS 2016. Perencanaan bangunan tahan gempa harus daktail sehingga dapat menahan respon inelastik sehingga analisis struktur didesain dengan menggunakan Sistem Rangka Pemikul Momen Khusus (SRPMK) sesuai SNI 2847:2019. Dengan adanya pengaruh deformasi inelastik akibat gaya gempa maka gaya geser dasar rencan diambil berdasarkan hasil paling kritis menggunakan metode *Direct Displacement Based Design (DDBD)* sebagai beban dorong dan metode respon spectrum.

Hasil analisis *pushover* menunjukkan bahwa level kinerja struktur dengan metode ATC-40 didapatkan hasil level kinerja *Damage Control (DC)*

dengan nilai *drift* rata-rata tingkat sebesar 0,0111 untuk arah X dan 0,0104 untuk arah Y. Sedangkan dengan metode FEMA-440 didapatkan hasil level kinerja *Damage Control (DC)* dengan nilai *drift* rata-rata tingkat sebesar 0,0118 untuk arah X dan 0,0115 untuk arah Y. Sehingga hasil level kinerja dengan metode ATC-40 dan FEMA-440 masih dibawah level kinerja desain *Life Safety (LS)* 0,02.

Kata kunci: *Pushover, Performance Based Design, SRPMK, Direct Displacement Based Design, Respon Spektrum, Tingkat Kinerja*

STRUCTURE REDESIGN AND DIRECT DISPLACEMENT BASED DESIGN
(DDBD) ANALYSIS
AT BNI DR CIPTO SEMARANG BUILDING

ABSTRACT

The area in Indonesia is an area that is prone to earthquakes because it is crossed by the Eurasian plate and the Indo-Australian plate. Earthquake-resistant building planning needs to be done to minimize the influence of earthquake forces. Currently, one of the concepts for planning earthquake-resistant buildings is Performance-Based Design with the static thrust load method or pushover analysis. Pushover analysis is able to provide information on the pattern of collapse when the building is loaded with earthquake forces so that the level of performance of the building can be known. Performance levels can be rated based on ATC-40 and FEMA-440.

The purpose of writing this final project is to redesign the structural components with a special moment frame system (SRMK) and determine the performance of the structure with pushover analysis of earthquake resistance according to ATC-40 and FEMA-440, with performance categories Operational, Immediate Occupancy, Life Safety, Collapse Prevention.. In this analysis, a 6-storey office building is reviewed with an earthquake location in Semarang. The analysis was carried out with the help of the ETABS 2016 software. The design of earthquake-resistant buildings must be ductile so that they can withstand inelastic responses so that the structural analysis is designed using the Special Moment Resistant Frame System (SRPMK) according to SNI 2847:2019. With the influence of inelastic deformation due to earthquake forces, the design base shear force is taken based on the most critical results using the Direct Displacement Based Design (DDBD) method as the thrust load and the response spectrum method.

The results of the pushover analysis show that the performance level of the structure using the ATC-40 method results in a Damage Control (DC) performance level with an average drift value of 0.0111 for the X direction and

0.0104 for the Y direction. Meanwhile, the FEMA-440 method The results of the Damage Control (DC) performance level are obtained with an average drift value of 0.0118 for the X direction and 0.0115 for the Y direction. So that the performance level results with the ATC-40 and FEMA-440 methods are still below the Life design performance level. Safety (LS) 0.02.

Keywords: Pushover, Performance Based Design, SRPMK, Direct Displacement Based Design, Response Spectrum, Performance Level