Analisis Desain Bangunan Gudang Tiga Lantai Sistem Rangka Pemikul Momen Khusus (SRPMK) Tanpa dan Dengan Post-Tension (PT) Flat Slab = Analysis of Three-Storey Warehouse Building Design of Special Moment Resisting Frame System (SMRFS) Without and With Post-Tension (PT) Flat Slab

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Abstrak

Bangunan studi kasus gudang terdiri dari 3 lantai dengan bentang tipikal 11.4 m (kecuali pada bagian driveway terdapat bentang 17.1 m) dan tinggi antar lantai 11.2 m. Struktur menggunakan beton fc’ 40 MPa dan tulangan baja BjTS 420B. Struktur ini menanggung beban hidup gudang sebesar 25 kN/m2, beban hidup driveway 15 kN/m2, dan atap datar 1 kN/m2. Sementara itu, beban gempa yang diberikan adalah gempa respons spektrum. Bangunan ini berlokasi di Depok dengan kelas situs tanah lunak sehingga termasuk kategori desain seismik D dan memiliki sistem pemikul gaya seismik berupa sistem rangka pemikul momen khusus (SRPMK). Desain struktur bangunan dilakukan dengan dua skema, yaitu struktur Konvensional di mana digunakan pelat dua arah yang menumpu balok sebagai media transfer beban ke kolom dan struktur post-tensioned flat slab (PTFS) di mana digunakan pelat dua arah prategang yang secara langsung menumpu kolom dengan penebalan berupa drop panel. Pada struktur PTFS dilakukan pemisahan sistem penahan gaya gravitasi dan lateral (SGLR). Kolom penahan beban gravitasi saja akan dicek menggunakan prinsip kompatibilitas perpindahan. Struktur PTFS memiliki periode getar, berat seismik, gaya geser dasar, dan maximal story displacement lebih besar dibandingkan struktur konvensional. Volume tulangan (35.355%), beton (1.421%), dan bekisting (26.683%) struktur PTFS lebih kecil dibanding struktur konvensional dengan terdapat penambahan volume untuk strand (100%). Perbedaan biaya terbesar terdapat pada komponen balok, di mana penggunaan post-tensioned flat slab mampu menghemat biaya sebesar 62.712%. Total penghematan yang terjadi adalah sebesar 9.161%.

..... The warehouse case study building consists of 3 floors with a typical span of 11.4 m (except for the driveway section where the span is 17.1 m) and a height between floors of 11.2 m. The structure uses fc' 40 MPa concrete and BjTS 420B steel reinforcement. This structure supports a warehouse live load of 25 kN/m2, a driveway live load of 15 kN/m2, and a flat roof load of 1 kN/m2. The given earthquake load is response spectrum earthquake. This building is located in Depok with a soft soil site class so it is classified as seismic design category D and has a seismic force resisting system in the form of a special moment resisting frame system (SMRFS). The building structure design is carried out using two schemes, namely a Conventional structure where a two-way slab supported by beam as a load transfer medium to the column is used and a post-tensioned flat slab (PTFS) structure where a two-way prestressed slab that directly supported by column with thickening. in the form of a drop panel is used. In the PTFS structure, there is a separated gravity and lateral resisting system (SGLR). Gravity-load-only columns will be checked using the principle of displacement compatibility. PTFS structure has a vibration period, seismic weight, base shear force, and maximum story displacement greater than conventional structure. The volume of reinforcement (35.355%), concrete (1.421%), and formwork (26.683%) for PTFS structure is smaller than conventional structures with strands volume (100%) added in the PTFS structure. The biggest cost difference is in the

beam components, where the use of post-tensioned flat slabs can save costs of 62.712%. The total savings that occur are 9.161%.