

# **Studi parametrik kinerja spun pile D450 dan D600 akibat pembebanan monotonik pada tanah soft clay = Parametric study of spun pile D450 and D600 performance due to monotonic loading in soft clay soil**

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## **Abstrak**

Pada tahun 2017, Kementerian PUPR melakukan revisi peta gempa yang meliputi pembaharuan sumber sumber gempa baru. Akibat meningkatnya potensi gempa, maka terjadi peningkatan seismic demand dalam perancangan bangunan tahan gempa. Perancangan bangunan tahan gempa sering menggunakan konsep performance based design (PBD). Konsep PBD mengijinkan terjadinya kerusakan pada bangunan melalui mekanisme sendi plastis. Konsep PBD belum dapat diaplikasikan pada struktur bawah, karena sulit untuk direparasi. PBD dapat dipelajari melalui analisa pushover, yaitu dengan membebani struktur secara lateral sampai struktur tersebut mengalami kegagalan.

Penelitian ini memodelkan spun pile berdiameter 450 dan 600 mm produksi dari salah satu BUMN di Indonesia. Spun pile tertanam dalam tanah kohesif berjenis soft clay sedalam 20 m. Koneksi antara spun pile dengan pile cap dianggap kaku, sehingga dimodelkan sebagai jepit. Ujung dari pile menumpu pada tanah keras yang dimodelkan sebagai sendi. Tanah dimodelkan sebagai nonlinear spring yang menambah kekakuan pada struktur. Pemodelan dilakukan dengan menggunakan SAP2000 V21.

Tujuan dari penelitian ini adalah mencari kekuatan, duktilitas, dan proses terbentuknya sendi plastis. Terdapat tiga buah parameter yang diujikan untuk mendapatkan gambaran kapasitas spun pile. Pertama, dilakukan variasi luas tulangan pada beton pengisi spun pile. Kemudian, kekakuan tanah dibedakan berdasarkan nilai undrained shear strength. Selanjutnya, parameter yang diuji adalah efek beban aksial yang berbeda.

Hasil dari penelitian menunjukkan bahwa penambahan pada ketiga parameter tersebut meningkatkan kekuatan pile secara keseluruhan sebesar 2-13%. Disisi lain, nilai duktilitas meningkat seiring dengan penambahan tulangan beton pengisi sebesar 2-15% , namun berkurang 2-10% pada penambahan kekakuan tanah dan beban aksial.

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In 2017, the Ministry of Public Works and Housing revised the earthquake map which included renewing of new earthquake sources. Seismic demands in the design of earthquake resistant buildings increase due to the increased potential of the earthquake. The design of earthquake resistant buildings often uses the concept of performance based design (PBD). The PBD concept allows damage to buildings through plastic hinge mechanism. The PBD concept cannot yet be applied to the lower structure, because its complications in repair. PBD can be studied through pushover analysis, by applying lateral load until the structure fails. This research investigates 450 and 600 mm diameter spun pile produced by one of the state-owned corporation in Indonesia. The spun pile is embedded in cohesive soil of soft clay type as deep as 20 m. The connection between the spun pile and the pile cap is a rigid connection, so it is modeled as fix. The pile tip rests on hard soil which is modeled as pin. The soil is modeled as nonlinear springs which adds rigidity to the structure. Modeling is done using SAP2000 V21.

The purpose of this research is to observe the capacity, ductility, and formation of plastic hinge. There are

three parameters tested in this study to obtain the capacity of pile. First, a variation of spun pile infilled concrete reinforcement area. Then, the stiffness of the soil which varies by the value of undrained shear strength. Furthermore, the parameters tested are different axial load effects.

The results of this study indicate that increasing the three parameters resulted in raising overall pile strength by 2-13%. On the other hand, the ductility value increases with the addition of reinforced concrete reinforcement by 2-15%, but decreases by 2-10% with the increase of soil stiffness and axial load.