Studi Pemodelan Fondasi Grup Tiang dengan Memasukkan Pembebanan Lateral pada Tanah Lempung = Modelling Study of Pile Group Foundation by Including Lateral Load in Clay Soil

Muhammad Reza Imansyah, author

Abstrak

Kemungkinan kejadian kegempaan di Indonesia sangat tinggi sehingga diperlukan struktur fondasi yang mampu menahan beban gempa dengan baik. Oleh karena itu, pada penelitian ini dilakukan studi pemodelan fondasi grup tiang dengan memasukkan pembebanan lateral sebagai simulasi beban gempa. Pemodelan ini memperhatikan keluaran berupa interaksi antara tiang fondasi dengan tanah pada tanah lempung. Selain itu, keluaran yang diperhatikan adalah seismic behavior berupa daktilitas dan kejadian sendi plastis yang dialami oleh tiang fondasi. Studi pemodelan dilakukan dengan mengacu pada penelitian Yuwono et al. (2020), di mana model fondasi grup tiang dibuat pada tanah lempung dengan variasi kuat geser undrained tanah 20 kPa, 40 kPa, 60 kPa, 80 kPa, dan 100 kPa. Pada penelitian ini, keluaran-keluaran yang diperhatikan mengikutsertakan pengaruh dari variasi kuat geser undrained tanah tersebut. Model tanah dan tiang dimodelkan dalam pendekatan nonlinier P-y dari Beam-on-Nonlinear-Winkler-Foundation (BNWF) melalui aplikasi OpenSees. Melalui pemodelan tersebut, dilakukan validasi penelitian terhadap model fondasi penelitian Yuwono et al. (2020)berdasarkan kurva pushover yang terbentuk. Dari penelitian ini, semakin besarnya nilai kuat geser undrained tanah maka kecenderungan nilai daktilitas lendutan semakin besar. Lalu, semakin besarnya nilai kuat geser undrained tanah juga mempercepat terjadinya sendi plastis pertama dan lebih memungkinan menghasilkan kejadian sendi plastis kedua. Nilai kuat geser undrained tanah yang semakin besar juga meningkatkan nilai gaya dalam momen bending dan aksial pada tiang-tiang fondasi. Pada penelitian ini, tidak terjadi kegagalan geser sama sekali pada seluruh tiang namun terjadi kegagalan lentur untuk lead pile pada tanah dengan kuat geser undrained tanah 100 kPa. Selain itu, terbentuk momen guling untuk fondasi grup tiang pada tanah dengan kuat geser undrained tanah 20 kPa dan 100 kPa. Adapun secara performa, nilai P-Multiplier yang semakin besar membuat peran tiang menjadi lebih besar pada sistem fondasi grup tiang dan semakin besarnya nilai kuat geser undrained tanah akan cenderung meningkatkan nilai faktor efisiensi grup.

.....The possibility of earthquakes in Indonesia is very high, so a foundation structure that can withstand earthquake loads is adequately needed. Therefore, in this study, a pile group foundation modeling study was conducted by including lateral loading as a simulation of earthquake loads. This model pays attention to the output in the interactions between the foundation piles and the soil on clay soil. In addition, the output considered is seismic behavior in the form of ductility and the occurrence of plastic hinges experienced by the foundation piles. The modeling study was conducted with reference to the research of Yuwono et al. (2020), in which the pile group foundation model is made on clay soils with variations in the undrained shear strength of the soil 20 kPa, 40 kPa, 60 kPa, 80 kPa, and 100 kPa. In this study, the observed outputs include the effects of variations in the undrained shear strength of the soil. The soil and pile models were modeled in the P-y nonlinear approximation of the Beam-on-Nonlinear-Winkler-Foundation (BNWF) via the OpenSees application. Through this modeling, research validation was carried out on the research foundation model of Yuwono et al. (2020) based on the pushover curve formed. From this study, the greater

the value of the undrained shear strength of the soil, the greater the tendency of the deflection ductility value. Then, the greater the value of the undrained shear strength of the soil also accelerates the occurrence of the first plastic hinge and is more likely to produce a second plastic hinge occurrence. The greater the value of the soil's undrained shear strength also increases the force's value in bending and axial moments on the foundation piles. In this study, there was no shear failure on the entire pile but flexural failure for the lead pile on the soil with an undrained shear strength of 100 kPa. In addition, the overturning moment is formed for pile group foundations on soils with undrained shear strengths of 20 kPa and 100 kPa. As for performance, the larger the P-Multiplier value, the greater the role of the pile in the pile group foundation system, and the greater the value of the undrained shear strength of the soil will tend to increase the value of the group efficiency factor.