Секция «Инженерная геология»

A pile-soil separation concerned model for laterally loaded rectangular piles embedded in layered soils

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Laterally loaded pile in the construction has a wide range of applications in landslide control, high-rise building foundation, bridge pier and so on[1,2]. The main bottleneck that affects the performance of laterally loaded piles is the deflection of the pile.Because the pile body and the surrounding soil mass can be regarded as a pile-soil system, the main parameter affecting the bearing capacity of the system is the displacement field of the pile-soil interface. Initially, the discrete soil mass is assumed to be a linear spring by Winkler, where the stiffness of the spring is equal to the deformation modulus of the soil mass, and a model of undivided pile is proposed[3].

The Majiagou landslide is able to be regarded as a rectangle (540 m long and 200 m wide), with 9.7 km^2 in area and 1.3 million m^3 in volume.17 stabilizing piles (a cross-section of 2m width and 3m height) are set to control the landslide, and each of them has a maximum total length of 22 m. Therefore, the moment of inertia of each pile is equal to $ba^3/12=4.5m^4$. There are three layers struck by piles and these three rock formations are sliding mass, weathered sandstone and weathered silty mudstone. In addition, the sliding mass (the first layer) is 14 m thick, the weathered sandstone (the second layer) is 3.74 m, the weathered silty mudstone (the third layer) is 4.26 m and the Young's modulus E of a stabilizing pile is 3.0×10^7 kPa. The coefficient of subgrade reaction for hard rock in bedrock K_{hr} is 1.75×10^5 kPa/m, while for weak rock in the bedrock K_w is 0.5×10^5 kPa/m.The actual displacement of pile top is 15.01 cm. The calculation of the pile top displacement obtained by the original method was 12.08 cm, while the calculated value of the pile top displacement obtained by our model was 15.73 cm.

This study shows that the model using pile-soil separation is more realistic than the traditional model**[4]**.When pile-soil separation occurs and the deflection of the pile is large, the effect of the effect is reduced by about 30% for piles with larger slenderness and moderate flexibility**[5]**.

References

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