Simplified Approach to Consider Cracking Effect on the Behavior of Laterally Loaded RC Piles

Ahmed M. Ebid

Abstract

Laterally loaded pile is a famous case of soil-structure interaction problem which was intensively studied by many researchers before. The techniques used to predict the behavior of laterally loaded piles were developed with increasing of the available computational capabilities from closed mathematical formulas to finite differences technique and finally linear finite elements technique. Recently, very sophisticated 3D elasto-plastic nonlinear finite element models were used to accurately predict that behavior. Unfortunately, those sophisticated models are too complicated to be used in practical design. Hence, the aim of this research is to introduce a much simpler and practical approach to predict the behavior of the laterally loaded concrete piles considering the nonlinear effect of concrete cracking. Special calculating tool based on finite elements is developed to carry out a parametric study of the behavior of a set of 24 piles with different aspect ratios, reinforcement ratios, relative stiffness and head constrains. The validity of the calculating tool is checked against case history field tests. The results of the parametric study show three different failure modes according to the flexibility of the pile. Comparing the results with the formulas of ECP (202/4) shows the matching in the ultimate lateral capacity, while the ultimate lateral deformations are about (127 to 132%) of the code prediction.

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