

Comparison of Response of 2 x 2 Pile Group Predicted by Von-Mises and Drucker-Prager Criteria

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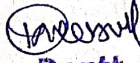
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Abstract. Pile group with 2 x 2 configuration, subjected to lateral load is analyzed using three dimensional finite element model. In house program is developed in FORTRAN. Pile and pile cap is modeled using 20 node elements whereas soil is modeled using 8 node elements. Interface elements are having 16 nodes. The interface is modeled such that the gapping between the pile and adjacent soil is not allowed but the slipping is allowed. The nonlinear behavior of soil is modeled using the Von-Mises criterion and Drucker Prager (inner) criterion. The parametric study revealed the influence of pile spacing, soil modulus, and pile length to diameter ratio on the lateral displacement of pile group and the maximum bending moment. The results predicted by both criteria are compared. The trends shown by the results predicted by both criteria during the parametric study are similar. However, the results predicted by the Von-Mises criterion are higher than Drucker Prager (inner) criterion.

Keywords: Finite Element Analysis, Von-Mises criteria, Drucker criteria, Non-linear behaviour

INTRODUCTION

Analysis of vertical pile or pile group subjected to horizontal load can be performed by the Winkler approach and elastic continuum approach. Finite element analysis is used in recent times. Reese and Matlock [1] employed a finite difference scheme for the case of subgrade reaction modulus having linear variation with depth. Davisson and Gill [2] extended this approach for piles embedded in the layered soil systems. Madhav and Sarma [3] carried out an analysis for an overhang pile embedded in homogeneous soil, by using the elastic continuum approach. The pile was subjected to axial as well as lateral load. It was observed that the load-displacement behavior depends predominantly on the magnitude of axial load. Faruque and Desai [4] reported nonlinear three-dimensional analysis piles embedded into soft saturated clays by incorporating material and geometric non-linearity. Results indicated that the inclusion of geometric non-linearity rendered the pile-soil system much stiffer as compared to the small strain analysis. Al-Obaid [5] presented an analysis in which the finite difference method was used to establish governing equations. The subgrade reaction approach was used and soil properties were governed by the p - y curves. Gabr et al. [6] used the results of dilatometer tests (DMT) in clay to construct static p - y curves. Tahghighi and Konagi [7] studied the interaction amongst soil, pile, and structure using the nonlinear Winkler foundation model. The results obtained from this Winkler model were compared with experimental data obtained from two tests. Acharyya et al. [8] conducted the theoretical and FE analysis to estimate the ultimate load carrying capacity and actual load transferred of 32 pile groups resisting on the horizontal ground surface. It was found that the developed load levels were substantially lesser than that of the evaluated capacity and the designed pile foundation was suitably safe.


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