Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 4, No. 9, September, 2018

Lateral Response of a Single Pile under Combined Axial and Lateral Cyclic Loading in Sandy Soil

Muqdad A. Kahribt [a*], Jasim M. Abbas [b]

[a] *MSc Student, College of Engineering, University of Diyala, Baqubah, Daiyla, Iraq.*

[b] *Assistant Prof, College of Engineering, University of Diyala, Baqubah, Daiyla, Iraq.*

Received 03 July 2018; Accepted 10 September 2018

Abstract

According to practical situation, there have been limited investigations on the response of piles subjected to combined loadings especially when subjected to cyclic lateral loads. Those few studies led to contradictory results with regard to the effects of vertical loads on the lateral response of piles. Therefore, a series of experimental investigation into piles in dense sand subjected to combination of static vertical and cyclic lateral loading were conducted with instrumented model piles. The effect of the slenderness ratio (L/D) was also considered in this study (i.e. L/D= 25 and 40). In addition, a variety of two-way cyclic lateral loading conditions were applied to model piles using a mechanical loading system. One hundred cycles were used in each test to represent environmental loading such as offshore structures. It was found that under combined vertical and cyclic lateral loads the lateral displacement of piles decreased with an increase in vertical load whereas it causes large vertical displacements at all slenderness ratios. In addition, for all loading conditions the lateral, vertical (settlement and upward) displacements and bending moments increased as either the magnitude of cyclic load or the number of cycles increases.

Keywords: Piles; Lateral Response; Sand; Cyclic Load.

1. Introduction

In general, Pile foundations are widely used to support various important structures such as offshore platforms, jetties, wharfs, docks, dolphin structures, and bridges. These piles are used to support vertical loads, lateral loads and combination of vertical and lateral loads. Combined loading is defined as cyclic lateral loading due to environmental (wave and wind) loads action and vertical load due to self-weight of structures. In an overview of lateral loaded pile studies, the vertical and lateral responses of piles are often evaluated separately neglecting their possible interaction. This would lead to an erroneous design, as pile foundations for several types of structures are subjected to simultaneous vertical and lateral loading. The separate consideration of the vertical and lateral loading therefore cannot be expected to account properly for the pile behavior [1-4]. The methods of analysis commonly used in predicting the response of a single pile are the elastic half space method, and the nonlinear subgrade reaction method. Both of these methods assume that axial and lateral loads act independently and that there is no interaction. The behavior of pile foundations under either vertical or lateral loads has been investigated for more than a century through full-scale tests, small-model tests or numerical analysis, even though pile response under combined loads can be significantly different from that of piles under either vertical or cyclic lateral loads due to the interaction of vertical and cyclic lateral loads. The influence of vertical loads on the lateral response of pile foundations needs to be accounted for in optimum design; however, only

* Corresponding author: muqdadabd1@gmail.com

http://dx.doi.org/10.28991/cej-03091133