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The horizontal resistance of a steel pile installed in a soil cement column

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ABSTRACT

In the case of constructing a marine structure on a soft ground, steel pipe piles were often used for the foundation. A price of the steel pile is, however, increasing year by year because of increasing demand of steel products. Therefore, a still pipe pile installed in a soil cement column has been developed. Advantages of this pile are having high performance of bearing capacity and horizontal resistance for its small radius of the pile, because the pile wears the soil cement column cast. This method, however, has not been sufficiently understood on its plastic deformation characteristics and high performances because of its short experience.

In this research, a series of centrifuge model tests for the pile in a soil cement column horizontally loaded and the fiber model analyses of the pile were conducted to examine the effectiveness of the column wearing and the plastic response of the pile after yielding.

As a result of these tests, it was concluded that the pile installed in a soil cement column had higher resistance to horizontally loading than a steel pipe pile without install of a column.

KEY WORDS: Steel pile; soil cement column; subgrade reaction model; yield bending moment; Centrifuge model test.

INTRODUCTION

In the case of constructing a marine structure on a soft ground, steel pipe piles were often used for the foundation. A price of the steel pile is, however, increasing year by year because of increasing demand of steel products. Therefore, a still pipe pile installed in a soil cement column has been developed for reducing a cost of the pile and preserving the performance. Advantages of this pile are having high performance of bearing capacity and horizontal resistance for its small radius of the pile, because the pile wears the soil cement column cast. This piling method, however, has not been sufficiently understood on its plastic deformation characteristics and high performances because of its short experience.

Pile behavior under static lateral loading has a many literatures are available on this subject. The simplified model was used to predict the response of laterally loaded piles in stiff clay (Reese, Cox and Koop. 1975) and in sand (Brown, Morrison and Reese. 1988). Trochanis et al.(1991) was compare 1D model with test data. The agreements between model predictions for the displacement versus the load and the depth distribution of bending moment and field measurements were good. Tobita, et al (2004) performed several centrifuge model tests for group pile. However, these literatures were focused on pile only.

The purpose of this study is to assess the plastic response of a steel pile installed in a soil cement column by using fiber model analysis and centrifuge model test. The fiber model analysis is one of the bending deformation analyses, which can consider material non-linear characteristic and complexity caused by some different comprised members.

M-Φ RELATIONSHIP OF A COLUMN PILE