EFFET OF MICROPILES IN CONTROLLING THE IMPACT OF PIPELINE DETERORTION ON ADJACENT BUILDINGS

By

NAJIA ASSEM MOHAMED MAHFOUZ

A Thesis Submitted to
The Faculty of Engineering, Cairo University
In Partial Fulfillment of the
Requirement for the Degree of
Master of Science
In
Structural Engineering

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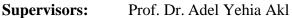
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Key Words:

Pipelines, building, soil, micropile.

Summary:

Sewer pipelines deterioration had a high impact on the settlement of surrounding structures in urban areas. In this research, the effect of using micropiles in controlling the settlement of structures affected by sewer pipelines deterioration was studied. A three-dimensional finite elements model was implemented, utilizing the "ANSYS 11" software. Different parameters were investigated: the effect of the length of micropile, the distance of micropile from the footing of building, the diameter of micropile , the inclination angle from the vertical axis , and finally types of Footing.



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Abstract

Sewer pipelines deterioration had a high impact on the settlement of surrounding structures in urban areas. After such incidents, adjacent structures should be supported to prevent building deterioration due to continuous settlement of pipes.

Strengthening foundations with micropiles is progressively being used, due to the major advantages that this technique presents. Nevertheless, the influence of some relevant parameters in the overall behavior of the retrofitted foundations has not yet been studied. Generally, micropiles are installed in holes drilled through the existing RC footing, which are then filled with grout.

This thesis presents the numerical analysis results of three-dimensional (3-D) Finite Elements Method, utilizing "ANSYS 11" software, to simulate the relationship between: pipes, structures, micropiles and surrounding soil ,the objective is to calculate the effect of micropiles in reducing settlement of soil under building structure.

At first a soil media with properly given properties is modeled and the damage in pipeline, and its settlement are studied. Then, micropiles with variable diameter and with various lengths; 5m to 11m are added and the settlement of footing is studied.

Then, the settlement graphs for this soil with various inclinations 0 to 20 degree with the vertical axes which are used in practical usages inserted and with various number of micropiles in this soil a settlement of footing is studied. Finally, comparisons between results obtained from these studies are done. The obtained results show that use of micropiles in sandy soils leads to decrease in settlement. The results of this study can provide valuable information about use of micropiles in soils.

Chapter 1: INTRODUCTION

1.1 Background

Soil-Structure interaction is widely covering several areas of civil engineering problems. The interaction between ground and several underground structural elements has a major effect in settlement in structural building. Studying soil-structure interaction for several cases is most important to control damage in structural building. Nowadays studying numerical models for soil-structure interaction by software could appropriately simulate the real case for buildings.

One of the most important problems of soil structure interaction is sewer pipelines deterioration had a high impact on the settlement of surrounding structures in urban areas. After such incidents, adjacent structures should be supported to prevent building deterioration due to continuous settlement of pipes.

Micropiles has a recognizable effect in increasing the bearing capacity and reducing the displacement of building particularly and in strengthening the foundations.

In this research, the study of the effect of using micropiles on settlement of building under pipelines deterioration is performed with two steps; steady state and pipeline failure state. The steady state step is concerned for effect of settlement of soil.

The pipeline failure operation is modeled by settlement of the building with using micropiles to strength building. Different parameters were investigated to reach such goal: the effect of the length of micropile, the distance of micropile from the footing of building, the diameter of micropile, the inclination angle from the vertical axis, number and arrangement of micropile, and finally types of foundation.

This paper presents the numerical analysis results of three-dimensional (3-D) Finite elements Method, utilizing the "ANSYS 11" software, to simulate the relationship between: micropiles, pipes, structures and surrounding soil to calculate the effect of micropiles in reducing the settlement of soil under building structure. ANSYS software is widely used for analyzing such cases for soil mechanics, linear, and nonlinear.