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شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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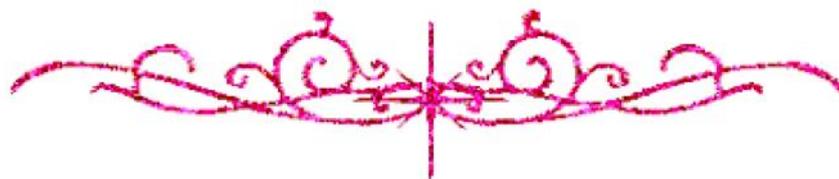


بعض الوثائق الأصلية تالفة





بالرسالة صفحات لم ترد بالأصل





AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT

**INFLUENCE OF USING CONTROLLED MODULUS COLUMNS
(CMCs) ON LOAD-DEFORMATIONS BEHAVIOR OF SOFT SOILS**

Thesis

Submitted in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

IN

CIVIL ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

BY

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AIN SHAMS UNIVERSITY
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Name : Mohamed Mohamed Salah Hassan Omar El-Gendy

Thesis : Influence of Using Controlled Modulus Columns (CMCs) on
Load-Deformations Behavior of Soft Soils

Degree : Master of Science in Civil Engineering

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Date: / / 2020



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Postgraduate Studies

Authorization stamp: The thesis is authorized at / / 2020

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/ / 2020

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STATEMENT

This thesis is submitted to Ain Shams University for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author at the Department of Structural Engineering, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institution.

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ABSTRACT

Civil work faces many challenges, including the difficulty of dealing with soft soil stratum. As the soft soil deposits are mainly characterized by their high voids ratio and their needle-like shaped microscopic particles, they tend to exhibit larger deformation values and lower shear strength compared to other soil types. Thus, to overcome such problems when dealing with soft soil deposits, different soil improvement methods can be used such as Soil improvement using Controlled modulus columns (CMCs), which is one of the types of improvement using rigid inclusions.

(CMCs) are a lean sand mix mortar column placed in a network adapted to loads and settling criteria, combined with a granular bed. This distribution bed spreads the applied load between the ground and the CMC.

The basal reinforced embankment is a one of the most important applications of ground improvement using CMCs where the loads of a highway or railway track are distributed to the ground and inclusions; moreover, basal reinforced embankments, i.e., piled embankments, can be used as a foundation system for rigid structures. A piled embankment consists of a matrix of CMCs below an embankment constructed using granular materials, in addition to a geosynthetic reinforcement layer (GR) on top of the CMCs. This technique can be built at a fast rate and has a small settlement after construction value, which in turn translates to lower maintenance costs for the structure itself. Furthermore, piled embankment minimizes the horizontal movement of the subsoil, which results in the ability to apply such a method

next to sensitive buildings, existing cables, pipelines, susceptible foundations.

Generally, CMCs are installed without steel reinforcement when constructing as a ground improvement for facilities that allow this, but there are some locations beneath the same facilities that require a reinforcement CMCs.

Numerical modeling provides a suitable tool to investigate the performance of the rigid inclusions (CMCs) in the load distribution mechanism and the reduction of both the settlement and the differential settlement. Three-dimensional finite element analysis can give an adequate image of the load transfer behavior and arching action between the field of inclusions.

The finite element code PLAXIS 3D 2020 is utilized to simulate a case study of a laboratory-scale test of the piled embankments where a group of CMCs is placed in soft material with a geosynthetic reinforcement on top over which an embankment is constructed. A sensitivity study is performed to investigate the influence of the embankment shear parameters and the subsoil modulus of elasticity on the load distribution values between the rigid inclusions and subsoil, moreover, the effect on the GR layer deflection in various locations.

A comparison is performed between the load parts values and GR vertical displacement which measured from the scaled model test and calculated values estimated from the numerical model to verify the FE model and hence verify the analytical model that used to determine the load parts values

transfer to the inclusions and subsoil also determine the settlement of the subsoil.

The rigid inclusions technique is applied in some structures to study the availability of this method and investigate the need for the reinforcement according to the created straining actions along the inclusion shaft in both static and seismic cases.

Keywords:

Piled embankment; Physical model; Arching; Soft subsoil; Reinforcement; Geo-synthetics.

SUMMARY

The basal reinforced embankments are one of the most important applications of the CMCs to distribute a load of a highway or railway track to the ground; moreover, basal reinforced embankments, i.e., piled embankments, can be used as a foundation system for rigid structures. A piled embankment consists of a matrix of piles below an embankment constructed using granular materials, in addition to a geosynthetic reinforcement layer (GR) on top of the piles. This technique can be built at a fast rate and has a small settlement after construction value, which in turn translates to lower maintenance costs for the structure itself. Furthermore, piled embankment minimizes the horizontal movement of the subsoil, which results in the ability to apply such a method next to sensitive buildings, existing cables, pipelines, susceptible foundations.

Numerical modeling provides a suitable tool to investigate the performance of the rigid inclusions in the load distribution mechanism and the reduction of both the settlement and the differential settlement. Three-dimensional finite element analysis can give an adequate image of the load transfer behavior and arching action between the field of inclusions.

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