



Ain Shams University

Faculty of Engineering

MASTER THESIS

**PERFORMANCE OF A GEOGRID-REINFORCED AND PILE
SUPPORTED HIGHWAY EMBANKMENT OVER SOFT CLAY**

BY

ANTOINE EDMOND ALBERT

B.Sc. in Civil Engineering (2007),

UNDER THE SUPERVISION OF

Dr. Ashraf Hefny

Associate Prof. of Geotechnical Eng.
Department of Structural Engineering
Faculty of Engineering
Ain Shams University

Dr. Tamer Mohamed Sorour

Assistant professor of Geotechnical Eng.
Department of Structural Engineering
Faculty of Engineering
Ain Shams University

EXAMINE COMMITTEE

Name, Title & Affiliation

Signature

1- **Prof. Dr. Abd El Wahed Gaber**

.....

Professor of Geotechnical Eng.
Department of Structural Eng.
Faculty of Engineering
Al-Azhar University

2- **Prof. Dr. Ali Adb El Fattah**

.....

Professor of Geotechnical Eng.
Department of Structural Eng.
Faculty of Engineering
Ain Shams University

3- **Dr. Ashraf Mohamed Hefny.**

Associate Professor of Geotechnical Eng.
Department of Structural Engineering
Faculty of Engineering
Ain Shams University

.....

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Engineering science in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Structural Engineering, Ain Shams from 2009 to 2014

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

Date 31/12/2014

Signature:

Name: Antoine Edmond Albert

INFORMATION ABOUT THE RESEARCHER

Name: Antoine Edmond Albert

Date of birth: December. 9, 1984

Place of birth: Cairo Egypt

Qualification: B.S.C. Degree in civil engineering
(Structural Eng. Depart.) – Ain Shams (2007).

Present Job: Geotechnical Engineer in Dar el Handasah
Consultant Company.

ABSTRACT:

Construction of high embankment on soft ground is usually susceptible to bearing capacity failure, intolerable total and differential settlement, large lateral pressure and movement, and slope stability. A variety of techniques can be applied to solve these problems. However some of these methods are limited due to complex conditions of strata, construction period and economic conditions.

The techniques used to solve the soft soil problems includes techniques to modify the embankment load on the ground (lightweight materials, change in embankment geometry), techniques to improve the ground (preloading, surcharging, staged construction, excavation and replacement, stone columns, lime columns), techniques to accelerate consolidation (vertical drainage and vacuum consolidation), techniques to reinforce the road embankment fill (reinforcement), and techniques to provide additional structural support to the embankment (embankment support piles). Each alternative has its own advantages and disadvantages.

Building embankments on a grid of piles or columns that are driven or constructed to a more competent underlying layer, the embankment

load is transferred almost entirely to the piles, and thus to the competent layer, and therefore the problems associated with the soft soils can be avoided. The mechanism that allows that load transfer is soil arching. It has been found that the addition of one or more geogrid layers at the base of the embankment, just above the piles, facilitates the transfer of the embankment load to the piles, and allows for greater pile spacing.

The objective of this research is to investigate numerically the behavior of piled earth embankments constructed on soft clay soil and reinforced by geogrid. A case history of a piled earth embankment that is constructed on a soft clay formation reinforced by piles and geogrid will be analyzed and a comparison between the predicted and monitored responses will be presented, in order to evaluate the adequacy of the numerical model, in addition, a parametric study discussing the effect of different variable on the stability of the embankment will be performed.

The computed values were in good agreement with the field measurements. And the parametric study shows the big change of the settlement by changing the different parameters, such as pile spacing and/or the pile diameter, and the effect of Geogrids on the vertical settlement affecting the soil due to the embankment load.

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