



Ain Shams University  
Faculty of Engineering  
Department of Structural Engineering

# **Behavior of a laboratory model for footings resting on erratic formation of swelling soil and sand**

BY

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**THESIS**

Submitted in partial fulfillment of the requirements for  
Degree of Master of Science in Civil Engineering  
Structural Engineering Department  
(Geotechnical Engineering)

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(...رَبِّ أَوْزَعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ  
الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ  
وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وَأَدْخِلْنِي  
بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ)

صدق الله العظيم

النمل.. آية رقم ١٩





*I would like to dedicate this thesis to all members in **My Family** for supporting me and pushing me forward all the time.*





## APPROVAL SHEET

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Title of Thesis: "Behavior of a laboratory model for footings resting on erratic formation of swelling soil and sand"

Degree : Master of Science in Civil Engineering  
(Structural Engineering)

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## STATEMENT

This dissertation 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 in the Department of structural Engineering, Ain Shams University from 2009 to 2013.

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

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### **Behavior of a laboratory model for footings resting on erratic formation of swelling soil and sand**

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#### **Abstract**

Expansive clay is one of the most detrimental problematic soils in Egypt. The expansive soil appears in new civilization cities. In site, the soil formations of expansive soil are composed mainly fine or coarse sand formation with erratic formation (lumps) of expansive soil. This research aims to study the behavior of footings resting on erratic formation of swelling soil (lump) and sand to set the suitable remedies and to avoid heave related damages. A laboratory test program is design to determine the expansive behavior for laboratory footing models resting on lump is composed of different percentage of swelling clay and medium-fine sand by using large laboratory model test. Laboratory tests are performed to study the geotechnical characteristics for two grained of sand (medium-fine and fine) and three type of expansive soil. The study factors are preformed on lump of expansive soil and medium-fine sand to discuss their effect on the footing and ground surface movement. The studied factors are lump width, lump depth, lump thickness, lump clay content and lump clay type. Results of model movement are presented and evaluated. The results indicates that the final heave of footing doesn't affected by the lump when lump width  $\leq$  footing width and lump depth equal to 2 footing width. Also the final heave of footing increases with increase of lump thickness, lump clay content and lump clay activity.

**Key word:** Lump, Laboratory model, Footing movement, ground surface, width, thickness, depth, activity and clay content.



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