Chapter 1
INTRODUCTION

1.1 GENERAL

Soil pressures below shallow foundations and earth retaining structures, subjected to moments due to oblique or eccentric loads, are not generally uniform. The non uniformity of the soil pressure tends to tilt the footing. This tilt increases as the eccentricity of the load increases and consequently the bearing capacity decreases. As a result, the required footing size increases and the design become uneconomical.

The amount of tilt and the pressure distribution under the footing base depend on the value of load eccentricity (e) divided by footing width (B). When the ratio (e/B) exceeds 1/6, the footing loses some of its contact with the soil.

It is evident that particles of cohesionless soil under a footing subjected to uniaxial eccentric load tend to move laterally towards the farther footing edge from the eccentric load. If a single vertical skirt is connected to the footing on this side, there may be a tendency for the soil to move laterally. This will alter the stress and displacement pattern within the footing-soil interface.

1.2 SCOPE OF THE STUDY

The general objective of the present research is to study the behavior of skirted strip footings under the effect of oblique and eccentric loading. The scope of the proposed research comprises an experimental investigation and a numerical work. First, a physical model was constructed in the laboratory and load response was recorded for experiments with different footing and loading parameters. Second, the laboratory experiments was modeled using numerical simulation.

The experimental tests have the advantage of simulating the performance of the footing-soil system during the working loads up to the failure state. Hence, it provides the real failure loads and deformations.

The experimental work, in the present research is focused on studying the effect of variation of load eccentricity, load inclination angle, and skirt length on the behavior of skirted footing. The study will also include the effect of variation of skirt angle with the vertical, and the variation of soil density.

The software package PLAXIS, developed by Brinkgreve and Vermeer (1998), is used to numerically reproduce the experimental work. The numerical simulation has the ability to provide detailed picture of the stresses and deformations within the analyzed system, and to include other parameters not accounted for in the experimented work. In other words, the experimental and analytical research can complement each other in leading to a better understanding of the behavior of skirted footings than if either line of research is individually used.

The following is a brief description of the subsequent chapters comprised this work:

Chapter 1 presents the general introduction and the scope of the investigation.
Chapter 2 gives a brief history on the use of skirts in footings design as well as a review of the previous work relevant to the evaluation of the bearing capacity and settlement of shallow foundations under eccentric and inclined loads.
Chapter 3 illustrates the objectives of the laboratory investigation and presents details of both the test set up and the test program.
Chapter 4 presents the experimental footing model test results conducted on skirted footings subjected to vertical eccentric loads.
Chapter 5 presents the experimental footing model test results conducted on skirted footing subjected to inclined eccentric loads.

Chapter 6 shows the numerical simulation of skirted footings under various loading conditions. It provides a comparison between the results of the numerical and experimental works. It includes the finite element analysis of the soil deformations and stresses.

Chapter 7 includes the summary and conclusions of the research, and recommendations for future studies.