CHAPTER I

INTRODUCTION

1.1 Problem Statement

Pile caps have been designed for many years using the principles of reinforced concrete design and the provisions of the American Concrete Institute Building Code. As the ACI code has been changed over the years, slight changes in the details of standard pile cap designs have been made. Always, the basic principles of reinforced concrete design have of necessity been combined with considerable experience and engineering judgement to arrive at suitable proportions for the pile cap. When the pile loads are not very large the design of pile cap is essentially the same as that of a spread footing. As the pile loads become larger, the elements of judgement and experience become more vital and the pile cap design departs more from the conventional design.

Generally the piles in a group are spaced and the pile cap designed to achieve equal loads on each pile. The stiffness of the pile cap must be sufficient to justisfy the assumption of equal loads per pile. As the depth-span ratio becomes large the non-linear distribution of stress should be taken into account, that means the steel arrangement to a uniform grid by the simple bending theory may not meet a balance between technical and economic consideration.

As one of a reinforced concrete structure, there is always a numbers of different ways of detailing the reinforcement to complete a particular design and to satisfy the requirements of the codes. Hence, it is necessary to study the model of the internal force system in the pile cap to determine the most efficient steel layout. To take the advantages of the Finite Element Method and the potential of computers, the complete internal forces system in the pile cap can be determined and the preparation of reinforcement detailing can be produced.

Since the pile caps have been the prime concern with the strength of the building structures and a lack of basic data on how detailing affected strength, research in this field of study to determine the optimum reinforcement arrangements in pile caps is necessary.

1.2 Objective and Scope of Study

The objectives of this research are as follow:

1) To analyse the pile caps subjected to axial column load and the reactions on piles. To determine analytically the stress distribution and construct the internal forces system in pile caps by the Finite Element Method using the computer Stress Analysis Program.

2) To present the most suitable reinforcement arrangements that keep a balance between strength, practical and economic consideration.

3) To use a small scale model test to investigate the structural performance of the pile caps subjected to a vertical axial

column load. Of particular interest is the combination of load-deflection characteristics and the cracking patterns exhibited throughout the loading sequence, the mechanism of failure, and the load-strain relationship.

4) To compare the test results between the propose reinforcement details and the conventional type to obtain recommendations for practical design and structural detailing of pile caps.

The scope of this research will be confined to the study of four standard forms of pile caps,i.e., a square single-pile cap, a rectangular two-pile cap, a triangular three-pile cap, and a square four-pile cap. The stress distributions in each form of pile cap will be evaluated by the three dimensional stress analysis computer program based on the Finite Element Method. Only the vertical concentric column load is considered.

In the experimental investigations, one-third scale models of different proposed reinforcement arrangements will be designed, constructed, and tested to failure.